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STATEWIDE EMISSION INVENTORY of WYOMING

by

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Prepared by

GCA CORPORATION
GCA TECHNOLOGY DIVISION
Bedford, Massachusetts 01730

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16. Abstracts

The results of an emission inventory for the state of Wyoming are presented. Annual emission levels are established for the following five pollutants: particulates, sulfur dioxide, carbon monoxide, hydrocarbons and nitrogen oxides. The annual emission levels for each of the pollutants are established for each of the 23 counties in Wyoming, and for Cheyenne, Laramie and Casper. Totals for these pollutants are also presented for the three Federal Air Quality Control Regions in Wyoming. For each geographic breakdown, the emission levels for each pollutant are presented by the following source categories: Stationary fuel combustion sources; Transportation sources; Solid waste disposal; and Process losses.

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Air pollution
Emission
Inventories
Particles
Hydrocarbons
Sulfur dioxide
Carbon monoxide
Nitrogen oxides
Sources
Fuels
Combustion products
Transportation
Waste disposal
Processing

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Wyoming
Air Quality Control Regions
Particulates
Stationary sources

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I. INTRODUCTION

A. BACKGROUND OF PROGRAM

A primary purpose of the Federal Air Quality Act of 1967 was to provide for planning and control programs on a regional basis. More recently, the Environmental Protection Agency has required the preparation, adoption and submittal of implementation plans for meeting national ambient air standards by each of the states.

An important first step in implementation planning is the carrying out of an emissions inventory to determine the principal pollution sources in the state. The present report presents the results of an emission inventory for the state of Wyoming.

B. DESCRIPTION OF PROGRAM

The study program is concerned directly with establishing annual emission levels for the following five pollutants:

Particulates,
Sulfur Dioxide,
Carbon Monoxide,
Hydrocarbons,
and
Nitrogen Oxides

The annual emission levels for each of the pollutants are established for each of the 23 counties in Wyoming as well as for the three principal cities, Cheyenne, Laramie and Casper. In addition, totals for these pollutants are presented for the three Federal Air Quality Control Regions in Wyoming. Table I presents a listing of these regions together with the respective counties comprising them. Figure 1 presents a map of Wyoming, showing their geographic locations.

For each geographic breakdown discussed above (region, county, city) the emission levels for each of the 5 pollutants are presented by source category. These categories are:

TABLE 1

FEDERAL AIR QUALITY CONTROL REGIONS

Region No.	Counties Comprising Region
241	Converse
	Fremont
	Natrona
242	Albany
	Goshen
	Laramie
	Platte
243	Remaining 16 Counties and Yellowstone National Park

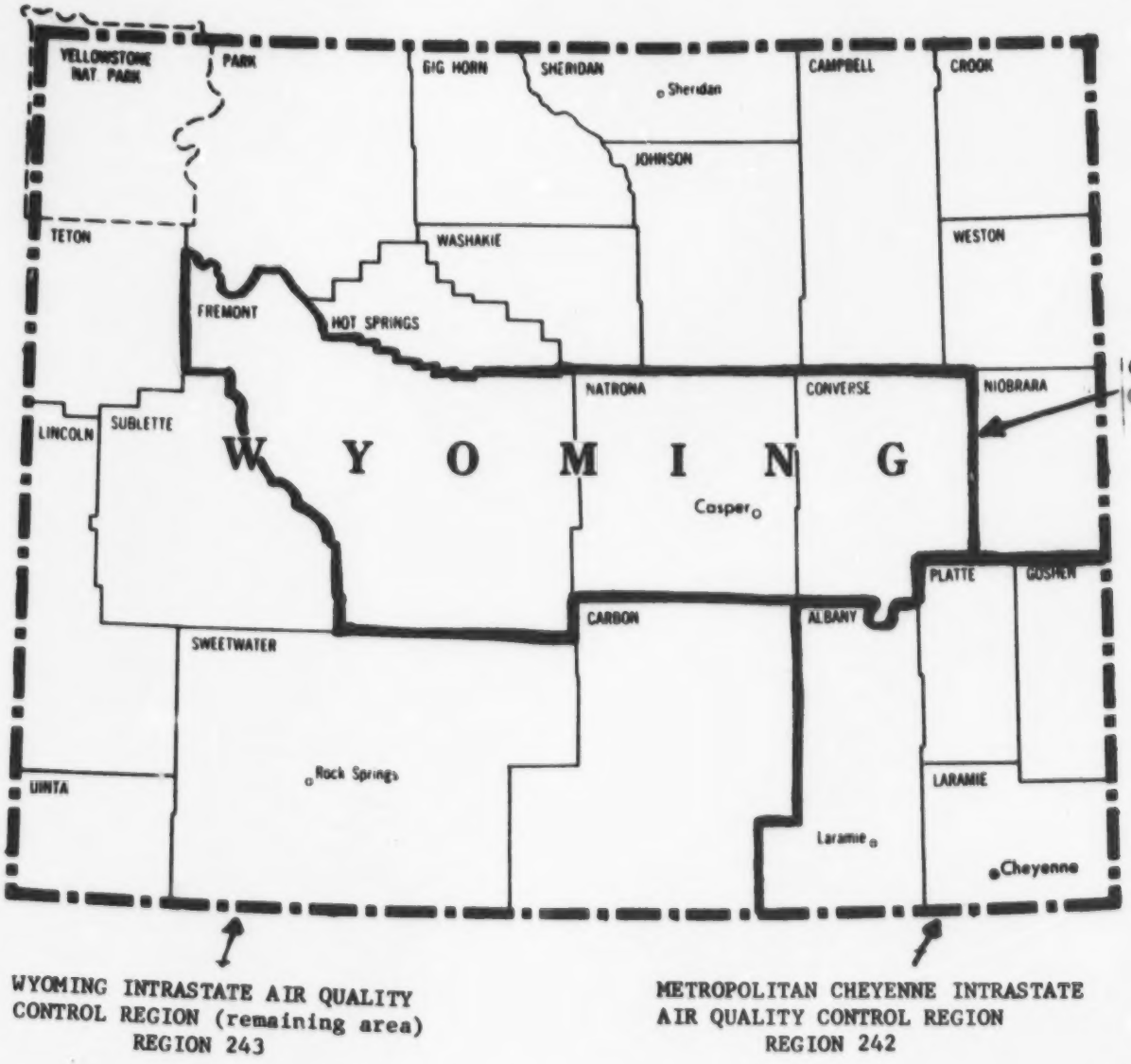

Figure 1. Boundaries of Air Quality Control Regions.

- Stationary Fuel Combustion Sources - which include power plants, as well as industrial, institutional, commercial, and residential facilities.
- Transportation Sources - these include both gasoline and diesel-powered motor vehicles, aircraft and railroads. Also included are evaporative losses from gasoline marketing.
- Solid Waste Disposal - municipal and private dumps which practice open burning, together with residential, commercial, institutional and industrial incineration and open burning comprise this source category. There are no municipal incinerators in Wyoming.
- Process Losses - these include stone crushing and processing, various minerals industries, asphalt and concrete batch plants, meat packing, organic and inorganic chemical facilities and several oil refineries. Also included are evaporative losses from petroleum bulk storage tanks, solvent evaporation in paints and varnishes, and solvent evaporation from dry cleaning.

C. USE OF THE INVENTORY

The data presented in this survey are not to be interpreted as absolute values. The pollutant emissions obtained should be considered as estimates to be used in defining the extent and distribution of air pollutant emissions in Wyoming. The data are accurate enough to be used in conjunction with ambient air quality measurements in the preparation of an implementation plan for meeting national ambient air standards.

II. SUMMARY

Tables 2 through 7 summarize the results of the emissions inventory program for Wyoming. Emissions from all pollutant source categories are presented and totalled for each of the Air Quality Control regions as well as for the three principal urban centers; Cheyenne, Casper and Laramie. For each of the three regions, however, emissions from the following point source categories were grouped together under the heading "Commercial, Institutional and Industrial - Other Point Sources":

- All commercial, institutional and industrial point sources whose emissions were reported rather than computer calculated.
- The combustion of sour gas at oil fields and refineries.
- Open burning of petroleum sludges primarily at oil fields.

Examination of these tables indicates that a primary source of particulate emissions is process losses from industrial point sources. These include stone crushing and processing, various minerals industries, asphalt and concrete batch plants, meat packing, organic and inorganic chemical facilities and several oil fields and refineries. In addition, when significant quantities of coal are utilized, such is the case in regions 241 and 243, coal combustion is also a major source of particulates.

Coal combustion is also a primary source of SO_2 emissions in region 241, region 243, and the City of Laramie. Sour natural gas, which is burned in large quantities in many oil refineries in Wyoming, is another significant SO_2 source. The combustion of residual oil and industrial process losses are the other two major sources of SO_2 emissions.

Emissions of carbon monoxide and hydrocarbons in Wyoming originate from three major sources: automobiles, on-site incineration, and industrial process losses. In region 242, conical burners used to incinerate wood scrap from lumber and saw mills also comprise a major source of CO emissions, and to a lesser degree, hydrocarbon emissions. In addition, the evaporation of gasoline during marketing and handling activities result in significant hydrocarbon emissions in all three of the Air Quality Control regions.

Emissions of oxides of nitrogen are attributed to three major sources in Wyoming: automobiles, sour natural gas burned at oil fields and refineries, and coal combustion. As mentioned earlier, significant quantities of coal are used in regions 241 (1.85 million tons) and regions 243 (1.73 million tons), and so coal is a major source of NO_x emissions in these regions. The burning of sour natural gas at refineries in regions 241 and 243, and outside the cities of Cheyenne and Casper, account for significant emission levels of NO_x in these respective areas.

TABLE 2

EMISSIONS INVENTORY SUMMARY FOR THE STATE OF WYOMING

AIR QUALITY CONTROL REGION 241

DATA REPRESENTATIVE OF CALENDAR YEAR 1970

	TONS OF POLLUTANT/YEAR					[illegible]	
	Particulate	SO_2	CO	HC	NO_x	Quantity	Units
I. FUEL COMBUSTION							
A. RESIDENTIAL FUEL-AREA SOURCE							
1. (ANTHRACITE) COAL	0	0	0	0	0		
2. DISTILLATE OIL	0	0	0	0	0		
3. NATURAL GAS	41	1	44	17	134	4,365	10^6 cu.ft/yr.
4. WOOD	0	0	0	0	0		
5. LPG	41	0	43	17	134	13,400	10^3 gal./yr.
6. TOTAL	82	1	87	34	318		
B. COMM-INSTL & IND							
1a. (BITUMINOUS) COAL-AREA SOURCE	0	0	0	0	0		
b. (BITUMINOUS) COAL-POINT SOURCE	0	0	0	0	0		
2. COKE-POINT SOURCE	0	0	0	0	0		
3a. DISTILLATE OIL-AREA SOURCE	1	4	0	0	3	99	10^3 gal./yr.
b. DISTILLATE OIL-POINT SOURCE	0	0	0	0	0		
4a. RESIDUAL OIL-AREA SOURCE	0	0	0	0	0		
b. RESIDUAL OIL-POINT SOURCE	123	1,602	1	16	327	10,976	10^3 gal./yr.
5a. NATURAL GAS-AREA SOURCE	41	1	44	17	134	4,365	10^6 cu.ft/yr.
b. NATURAL GAS-POINT SOURCE	125	5	2	382	4,287	14,571	10^6 cu.ft/yr.
6. PROCESS GAS-POINT SOURCE	0	0	0	0	0		
7a. WOOD-AREA SOURCE	0	0	0	0	0		
b. WOOD-POINT SOURCE	0	0	0	0	0		
8. LPG-AREA SOURCE	10	0	11	4	39	3,600	10^3 gal./yr.
9. OTHER-POINT SOURCE*	1	12,630	0	0	6		
10. TOTAL	303	14,242	58	319	4,826		
C. STEAM-ELECTRIC POWER PLANT							
1. ANTHRACITE COAL	0	0	0	0	0		
2. BITUMINOUS COAL	20,076	19,006	926	276	16,672	1,852,439	tons/yr.
3. DISTILLATE OIL	0	5	0	0	5	184	10^3 gal./yr.
4. RESIDUAL OIL	0	1	0	0	1	17	10^3 gal./yr.
5. NATURAL GAS	0	0	0	0	0		
6. TOTAL	20,076	19,012	926	276	16,678		
D. TOTAL FUEL COMBUSTION	20,461	33,275	1,071	629	21,822		
II. PROCESS LOSSES							
A. AREA SOURCES	0	0	0	1,487	0		
B. POINT SOURCES	3,495	4,355	70,750	4,801	93		
III. SOLID WASTE DISPOSAL							
A. INCINERATION							
1a. CM SITE-AREA SOURCE	1,381	20	11,841	3,947	39	78,937	tons/yr.
b. CM SITE-POINT SOURCE	0	0	0	0	0		
2. MUNICIPAL ETC.- POINT SOURCE	0	0	0	0	0		
B. OPEN BURNING							
1a. CM SITE-AREA SOURCE	0	0	0	0	0		
b. CM SITE-POINT SOURCE	0	0	0	0	0		
2a. DUMPS - AREA SOURCE	0	0	0	0	0		
b. DUMPS - POINT SOURCE	118	8	611	214	42	11,806	tons/yr.
C. CONICAL BURNERS - POINT SOURCE	266	4	4,970	423	39	76,176	tons/yr.
D. TOTAL SOLID WASTE DISPOSAL	1,765	30	17,422	4,584	120		
IV. TRANSPORTATION-AREA SOURCE							
A 1. MOTOR VEHICLES-GASOLINE	213	159	32,374	4,251	5,443		
2. MOTOR VEHICLES-DIESEL	474	172	260	587	959		
B. OFF-HIGH FUEL USAGE							
1. DIESEL	0	0	0	0	0		
2. GASOLINE	0	0	0	0	0		
C. AIRCRAFT	49	68	397	32	43		
D. RAILROADS	55	143	154	110	185	4,394	10^3 gal./yr.
E. GASOLINE HANDLING EVAP. LOSSES	0	0	0	5,430	0		
F. TOTAL TRANSPORTATION	791	542	33,185	10,410	6,819		
V. MISCELLANEOUS-AREA SOURCES							
A. AGRICULTURAL BURNING	0	0	0	0	0		
B. GRAIN ELEVATORS	0	0	0	0	0		
VI. GRAND TOTAL							
A. AREA SOURCE	2,306	568	45,188	15,819	7,172		
B. POINT SOURCE	24,204	37,634	77,260	5,816	21,475		
C. TOTAL	26,510	38,202	122,428	21,635	28,647		

*Includes combustion emissions when reported by point sources as well as the combustion of sour gas and the open burning of petroleum sludges at oil fields and refineries.

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TABLE 3

EMISSIONS INVENTORY SUMMARY FOR THE STATE OF WYOMING

AIR QUALITY CONTROL REGION 242

DATA REPRESENTATIVE OF CALENDAR YEAR 1970

	TONS OF POLLUTANT/YEAR					FUEL USE	
	Particulate	SO_2	CO	HC	NO_x	Quantity	Units
I. FUEL COMBUSTION							
A. RESIDENTIAL FUEL-AREA SOURCE							
1. (ANTHRACITE) COAL	0	0	0	0	0		
2. DISTILLATE OIL	0	0	0	0	0		
3. NATURAL GAS	28	2	54	20	189	5,031	10^6 cu.ft/yr.
4. WOOD	0	0	0	0	0		
5. LPG	13	1	55	22	199	17,300	10^3 gal./yr.
6. TOTAL	101	3	109	42	388		
B. COM-INSTL & IND							
1a. (BITUMINOUS) COAL-AREA SOURCE	0	0	0	0	0		
b. (BITUMINOUS) COAL-POINT SOURCE	1,100	650	64	34	513	68,400	tons/yr.
2. COKE-POINT SOURCE	0	0	0	0	0		
3a. DISTILLATE OIL-AREA SOURCE	1	4	0	0	5	185	10^3 gal./yr.
b. DISTILLATE OIL-POINT SOURCE	0	0	0	0	0		
4a. RESIDUAL OIL-AREA SOURCE	0	0	0	0	0		
b. RESIDUAL OIL-POINT SOURCE	1	18	0	0	2	68	10^3 gal./yr.
5a. NATURAL GAS-AREA SOURCE	28	2	50	20	189	5,031	10^6 cu.ft/yr.
b. NATURAL GAS-POINT SOURCE	55	1	1	120	327	8,149	10^6 cu.ft/yr.
6. PROCESS GAS-POINT SOURCE	0	0	0	0	0		
7a. WOOD-AREA SOURCE	0	0	0	0	0		
b. WOOD-POINT SOURCE	0	0	0	0	0		
8. LPG-AREA SOURCE	13	0	14	5	50	4,400	10^3 gal./yr.
9. OTHER-POINT SOURCE*	124	5,940	0	34	371		
10. TOTAL	1,322	6,617	133	213	1,057		
C. STEAM-ELECTRIC POWER PLANT							
1. ANTHRACITE COAL	0	0	0	0	0		
2. BITUMINOUS COAL	0	0	0	0	0		
3. DISTILLATE OIL	0	0	0	0	0		
4. RESIDUAL OIL	0	0	0	0	0		
5. NATURAL GAS	0	0	0	0	0		
6. TOTAL	0	0	0	0	0		
D. TOTAL FUEL COMBUSTION	1,643	6,640	238	277	2,345		
II. PROCESS LOSSES							
A. AREA SOURCES	0	0	0	1,660	0		
B. POINT SOURCES	44,227	936	39,500	9,140	121		
III. SOLID WASTE DISPOSAL							
A. INCINERATION							
1a. ON SITE-AREA SOURCE	1,994	28	17,089	5,696	57	113,924	tons/yr.
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2. MUNICIPAL ETC.- POINT SOURCE	0	0	0	0	0		
B. OPEN BURNING							
1a. ON SITE-AREA SOURCE	0	0	0	0	0		
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2a. DUMPS - AREA SOURCE	0	0	0	0	0		
b. DUMPS - POINT SOURCE	67	3	361	127	25	8,533	tons/yr.
C. CHEMICAL BURNERS - POINT SOURCE	2,820	40	32,000	4,400	400	800,000	tons/yr.
D. TOTAL SOLID WASTE DISPOSAL	4,881	71	49,450	10,223	482		
IV. TRANSPORTATION-AREA SOURCE							
A 1. MOTOR VEHICLES-GASOLINE	259	194	37,329	4,999	6,636		
2. MOTOR VEHICLES-DIESEL	586	213	320	725	1,182		
B. OFF-HIGH FUEL USAGE							
1. DIESEL	0	0	0	0	0		
2. GASOLINE	0	0	0	0	0		
C. AIRCRAFT	34	69	401	27	30		
D. RAILROADS	287	747	804	575	842	22,985	10^3 gal./yr.
E. GASOLINE HANDLING EVAP. LOSSES	0	0	0	6,330	0		
F. TOTAL TRANSPORTATION	1,166	1,223	39,054	12,656	8,710		
V. MISCELLANEOUS-AREA SOURCES							
A. AGRICULTURAL BURNING	0	0	0	0	0		
B. GRAIN ELEVATORS	0	0	0	0	0		
VI. GRAND TOTAL							
A. AREA SOURCE	3,323	1,262	56,312	20,079	9,399		
B. POINT SOURCE	28,594	7,608	81,930	13,877	2,159		
C. TOTAL	31,917	8,870	138,242	33,956	11,558		

*Includes combustion emissions when reported by point sources as well as the combustion of sour gas and the open burning of petroleum sludges at oil fields and refineries.

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TABLE 4

EMISSIONS INVENTORY SUMMARY FOR THE STATE OF WYOMING

AIR QUALITY CONTROL REGION 243

DATA REPRESENTATIVE OF CALENDAR YEAR 1970

	TONS OF POLLUTANT/YEAR					FUEL USE	
	Particulate	SO_2	CO	HC	NO_x	Quantity	Units
I. FUEL COMBUSTION							
A. RESIDENTIAL FUEL-AREA SOURCE							
1. (ANTHRACITE) COAL	170	210	353	133	55	22,100	tons/yr.
2. DISTILLATE OIL	0	0	0	0	0		
3. NATURAL GAS	71	2	75	30	282	7,509	10^6 cu.ft/yr.
4. WOOD	0	0	0	0	0		
5. LPG	77	1	81	31	290	25,200	10^3 gal./yr.
6. TOTAL	318	213	709	194	627		
B. COMM-INSTL & IND							
1a. (BITUMINOUS) COAL-AREA SOURCE	0	0	0	0	0		
b. (BITUMINOUS) COAL-POINT SOURCE	22	35	18	5	11	3,650	tons/yr.
2. COKE-POINT SOURCE	0	0	0	0	0		
3a. DISTILLATE OIL-AREA SOURCE	3	15	0	1	12	410	10^3 gal./yr.
b. DISTILLATE OIL-POINT SOURCE	106	417	1	34	444	14,904	10^3 gal./yr.
4a. RESIDUAL OIL-AREA SOURCE	0	0	0	0	0		
b. RESIDUAL OIL-POINT SOURCE	170	1,921	1	22	443	17,309	10^3 gal./yr.
5a. NATURAL GAS-AREA SOURCE	71	2	75	30	282	7,509	10^6 cu.ft/yr.
b. NATURAL GAS-POINT SOURCE	109	5	2	388	15,219	425,173	10^6 cu.ft/yr.
6. PROCESS GAS-POINT SOURCE	0	0	0	0	0		
7a. WOOD-AREA SOURCE	0	0	0	0	0		
b. WOOD-POINT SOURCE	0	0	0	0	0		
8. LPG-AREA SOURCE	19	0	20	8	72	6,300	10^3 gal./yr.
9. OTHER-POINT SOURCE*	343	2,871	33	371	115	0	
10. TOTAL	903	5,466	152	861	16,820		
C. STEAM-ELECTRIC POWER PLANT							
1. ANTHRACITE COAL	0	0	0	0	0		
2. BITUMINOUS COAL	13,706	15,580	1,002	357	22,740	1,721,464	tons/yr.
3. DISTILLATE OIL	0	0	0	0	0		
4. RESIDUAL OIL	0	0	0	0	0		
5. NATURAL GAS	21	1	0	46	201	2,300	10^6cu.ft/yr.
6. TOTAL	13,727	15,581	1,002	403	22,941		
D. TOTAL FUEL COMBUSTION	14,948	21,260	1,863	1,458	40,388		
II. PROCESS LOSSES							
A. AREA SOURCES	0	0	0	2,429	0		
B. POINT SOURCES	72,801	944	78,787	3,444	2,363		
III. SOLID WASTE DISPOSAL							
A. INCINERATION							
1a. ON SITE-AREA SOURCE	2,375	34	20,358	6,784	66	135,717	tons/yr.
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2. MUNICIPAL ETC.- POINT SOURCE	152	8	5	8	10	10,000	tons/yr.
B. OPEN BURNING							
1a. ON SITE-AREA SOURCE	0	0	0	0	0		
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2a. DUMPS - AREA SOURCE	0	0	0	0	0		
b. DUMPS - POINT SOURCE	424	36	2,144	757	137	33,567	tons/yr.
C. CHEMICAL BURNERS - POINT SOURCE	414	4	7,670	650	39	110,707	tons/yr.
D. TOTAL SOLID WASTE DISPOSAL	3,365	82	30,177	8,201	274		
IV. TRANSPORTATION-AREA SOURCE							
A 1. MOTOR VEHICLES-GASOLINE	643	483	99,006	11,965	16,491		
2. MOTOR VEHICLES-DIESEL	1,686	614	919	2,086	3,404		
B. OFF-HIGH FUEL USAGE							
1. DIESEL	0	0	0	0	0		
2. GASOLINE	0	0	0	0	0		
C. AIRCRAFT	42	108	628	35	38		
D. RAILROADS	652	1,696	1,826	1,305	1,957	32,180	10^3gal./yr.
E. GASOLINE HANDLING EVAP. LOSSES	0	0	0	12,804	0		
F. TOTAL TRANSPORTATION	3,025	2,901	92,379	28,193	21,890		
V. MISCELLANEOUS-AREA SOURCES							
A. AGRICULTURAL BURNING							
B. GRAIN ELEVATORS							
VI. GRAND TOTAL							
A. AREA SOURCE	5,811	3,165	113,541	37,643	22,951		
B. POINT SOURCE	88,328	22,022	87,645	8,084	41,666		
C. TOTAL	94,139	25,187	201,186	45,727	64,617		

*Includes combustion emissions when reported by point sources as well as the combustion of sour gas and the open burning of petroleum sludges at oil fields and refineries.

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TABLE 5

EMISSIONS INVENTORY SUMMARY FOR THE STATE OF WYOMING

CITY OF CASPER

DATA REPRESENTATIVE OF CALENDAR YEAR 1970

	TONS OF POLLUTANT/YEAR					FUEL ETC.	
	Particulate	SO_2	CO	HC	NO_x	Quantity	Units
I. FUEL COMBUSTION							
A. RESIDENTIAL FUEL-AREA SOURCE							
1. (ANTHRACITE) COAL	0	0	0	0	0		
2. DISTILLATE OIL	0	0	0	0	0		
3. NATURAL GAS	19	1	20	8	74	1,969	10^6cu.ft/yr.
4. WOOD	0	0	0	0	0		
5. LPG	21	0	22	8	77	6,712	10^3gal./yr.
6. TOTAL	40	1	42	16	151		
B. COMM-INSTL & IND							
1a. (BITUMINOUS) COAL-AREA SOURCE	0	0	0	0	0		
b. (BITUMINOUS) COAL-POINT SOURCE	0	0	0	0	0		
2. COKE-POINT SOURCE	0	0	0	0	0		
3a. DISTILLATE OIL-AREA SOURCE	0	0	0	0	0		
b DISTILLATE OIL-POINT SOURCE	0	0	0	0	0		
4a. RESIDUAL OIL-AREA SOURCE	0	0	0	0	0		
b. RESIDUAL OIL-POINT SOURCE	126	1,602	0	15	324	10,900	10^3 gal./yr.
5a. NATURAL GAS-AREA SOURCE	19	1	20	8	74	1,969	10^6cu.ft/yr.
b. NATURAL GAS-POINT SOURCE*	99	12,422	0	220	1,236	11,244	10^6cu.ft./yr.
6. PROCESS GAS-POINT SOURCE	0	0	0	0	0		
7a. WOOD-AREA SOURCE	0	0	0	0	0		
b. WOOD-POINT SOURCE	0	0	0	0	0		
8. LPG-AREA SOURCE	5	0	5	2	19	1,678	10^3gal./yr.
9. TOTAL	249	14,024	25	245	1,653		
C. STEAM-ELECTRIC POWER PLANT							
1. ANTHRACITE COAL	0	0	0	0	0		
2. BITUMINOUS COAL	0	0	0	0	0		
3. DISTILLATE OIL	0		0	0	0		
4. RESIDUAL OIL	0		0	0	0		
5. NATURAL GAS	0	0	0	0	0		
6. TOTAL	0	0	0	0	0		
D. TOTAL FUEL COMBUSTION	289	14,025	67	261	1,804		
II. PROCESS LOSSES							
A. AREA SOURCES	0	0	0	651	0		
B. POINT SOURCES	3,413	2,825	70,750	4,601	93		
III. SOLID WASTE DISPOSAL							
A. INCINERATION							
1a. ON SITE-AREA SOURCE	631	9	5,400	1,803	18	36,064	tons/yr.
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2. MUNICIPAL ETC.- POINT SOURCE	0	0	0	0	0		
B. OPEN BURNING							
1a. ON SITE-AREA SOURCE	0	0	0	0	0		
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2a. DUMPS - AREA SOURCE	0	0	0	0	0		
b. DUMPS - POINT SOURCE	1	0	3	1	0	109	tons/yr.
C. CONICAL BURNERS - POINT SOURCE	0	0	0	0	0		
D. TOTAL SOLID WASTE DISPOSAL	632	9	5,412	1,804	18		
IV. TRANSPORTATION-AREA SOURCE							
A 1. MOTOR VEHICLES-GASOLINE	16	10	6,392	856	469	49,642	10^3V-M/yr.
2. MOTOR VEHICLES-DIESEL	1	1	11	2	11	66	10^3gal./yr.
B. OFF-HIGH FUEL USAGE							
1. DIESEL	0	0	0	0	0		
2. GASOLINE	0	0	0	0	0		
C. AIRCRAFT	37	45	243	24	31		
D. RAILROADS	3	7	7	5	8	202	10^3gal./yr.
E. GASOLINE HANDLING EVAP. LOSSES	0	0	0	199	0		
F. TOTAL TRANSPORTATION	57	63	6,653	1,086	519		
V. MISCELLANEOUS-AREA SOURCES							
A. AGRICULTURAL BURNING	0	0	0	0	0		
B. GRAIN ELEVATORS	0	0	0	0	0		
VI. GRAND TOTAL							
A. AREA SOURCE	752	74	12,129	3,566	781		
B. POINT SOURCE	3,639	16,849	70,753	4,837	1,653		
C. TOTAL	4,391	16,923	82,882	8,403	2,434		

*Includes emissions from combustion of sour gas primarily at oil refineries.

TABLE 6

EMISSIONS INVENTORY SUMMARY FOR THE STATE OF WYOMING

CITY OF CHEYENNE

DATA REPRESENTATIVE OF CALENDAR YEAR 1970

	TONS OF POLLUTANT/YEAR					[illegible]	
	Particulate	SO_2	CO	HC	NO_x	Quantity	Units
I. FUEL COMBUSTION							
A. RESIDENTIAL FUEL-AREA SOURCE							
1. (ANTHRACITE) COAL	0	0	0	0	0		
2. DISTILLATE OIL	0	0	0	0	0		
3. NATURAL GAS	19	1	20	8	75	2,010	10^6 cu.ft/yr.
4. WOOD	0	0	0	0	0		
5. LPG	21	0	22	8	77	6,712	10^3 gal./yr.
6. TOTAL	40	1	42	16	152		
B. COMM-INSTL & IND							
1a. (BITUMINOUS) COAL-AREA SOURCE	0	0	0	0	0		
b. (BITUMINOUS) COAL-POINT SOURCE	0	0	0	0	0		
2. COKE-POINT SOURCE	0	0	0	0	0		
3a. DISTILLATE OIL-AREA SOURCE	0	0	0	0	0		
b. DISTILLATE OIL-POINT SOURCE	0	0	0	0	0		
4a. RESIDUAL OIL-AREA SOURCE	0	0	0	0	0		
b. RESIDUAL OIL-POINT SOURCE	102	4,028	0	18	384	10,052	10^3 gal./yr.
5a. NATURAL GAS-AREA SOURCE	19	1	20	8	75	2,010	10^6 cu.ft/yr.
b. NATURAL GAS-POINT SOURCE*	55	1,928	1	117	541	6,147	10^6 cu.ft/yr.
6. PROCESS GAS-POINT SOURCE	0	0	0	0	0		
7a. WOOD-AREA SOURCE	0	0	0	0	0		
b. WOOD-POINT SOURCE	0	0	0	0	0		
8. LPG-AREA SOURCE	5	0	5	2	19	1,678	10^3 gal./yr.
9. TOTAL	181	5,957	26	145	1,019		
C. STEAM-ELECTRIC POWER PLANT							
1. ANTHRACITE COAL	0	0	0	0	0		
2. BITUMINOUS COAL	0	0	0	0	0		
3. DISTILLATE OIL	0	0	0	0	0		
4. RESIDUAL OIL	0	0	0	0	0		
5. NATURAL GAS	0	0	0	0	0		
6. TOTAL	0	0	0	0	0		
D. TOTAL FUEL COMBUSTION	221	5,958	68	161	1,171		
II. PROCESS LOSSES							
A. AREA SOURCES	0	0	0	407	0		
B. POINT SOURCES	88	936	29,500	9,140	121		
III. SOLID WASTE DISPOSAL							
A. INCINERATION							
1a. ON SITE-AREA SOURCE	556	8	4,768	1,589	16	31,787	tons/yr.
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2. MUNICIPAL ETC.- POINT SOURCE	0	0	0	0	0		
B. OPEN BURNING							
1a. ON SITE-AREA SOURCE	0	0	0	0	0		
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2a. DUMPS - AREA SOURCE	0	0	0	0	0		
b. DUMPS - POINT SOURCE	0	0	0	0	0		
C. CONICAL BURNERS - POINT SOURCE	0	0	0	0	0		
D. TOTAL SOLID WASTE DISPOSAL	556	8	4,768	1,589	16		
IV. TRANSPORTATION-AREA SOURCE							
A 1. MOTOR VEHICLES-GASOLINE	56	34	21,861	2,927	1,405	169,807	10^3v-mi/yr.
2. MOTOR VEHICLES-DIESEL	2	4	32	6	33	194	10^3 gal./yr.
B. OFF-HIGH FUEL USAGE							
1. DIESEL	0	0	0	0	0		
2. GASOLINE	0	0	0	0	0		
C. AIRCRAFT	26	53	310	47	22		
D. RAILROADS	13	33	35	25	38	1,003	10^3 gal./yr.
E. GASOLINE HANDLING EVAP. LOSSES	0	0	0	323	0		
F. TOTAL TRANSPORTATION	97	124	22,238	3,330	1,498		
V. MISCELLANEOUS-AREA SOURCES							
A. AGRICULTURAL BURNING	0	0	0	0	0		
B. GRAIN ELEVATORS	0	0	0	0	0		
VI. GRAND TOTAL							
A. AREA SOURCE	717	134	27,073	5,252	1,960		
B. POINT SOURCE	245	6,892	29,501	9,275	1,046		
C. TOTAL	962	7,026	56,574	14,527	3,006		

*Includes emissions from combustion of sour gas primarily at oil refineries.

TABLE 7

EMISSIONS INVENTORY SUMMARY FOR THE STATE OF WYOMING

CITY OF LARAMIE

DATA REPRESENTATIVE OF CALENDAR YEAR 1970

	TONS OF POLLUTANT/YEAR					FUEL ETC.	
	Particulate	SO_2	CO	HC	NO_x	Quantity	Units
I. FUEL COMBUSTION							
A. RESIDENTIAL FUEL-AREA SOURCE							
1. (ANTHRACITE) COAL	0	0	0	0	0		
2. DISTILLATE OIL	0	0	0	0	0		
3. NATURAL GAS	11	0	12	5	43	1,158	10^6 cu.ft/yr.
4. WOOD	0	0	0	0	0		
5. LPG	11	0	13	5	45	3,912	10^3 gal./yr.
6. TOTAL	22	0	25	10	88		
B. COMM-INSTL & IND							
1a. (BITUMINOUS) COAL-AREA SOURCE	0	0	0	0	0		
b. (BITUMINOUS) COAL-POINT SOURCE	1,300	650	68	34	513		
2. COKE-POINT SOURCE	0	0	0	0	0		
3a. DISTILLATE OIL-AREA SOURCE	0	0	0	0	0		
b. DISTILLATE OIL-POINT SOURCE	0	0	0	0	0		
4a. RESIDUAL OIL-AREA SOURCE	0	0	0	0	0		
b. RESIDUAL OIL-POINT SOURCE	0	0	0	0	0		
5a. NATURAL GAS-AREA SOURCE	11	0	12	5	43	1,158	10^6 cu.ft/yr.
b. NATURAL GAS-POINT SOURCE*	5	0	0	12	50		
6. PROCESS GAS-POINT SOURCE	0	0	0	0	0		
7a. WOOD-AREA SOURCE	0	0	0	0	0		
b. WOOD-POINT SOURCE	0	0	0	0	0		
8. LPG-AREA SOURCE	3	0	3	1	11	982	10^3 gal./yr.
9. TOTAL	1,319	650	83	52	617		
C. STEAM-ELECTRIC POWER PLANT							
1. ANTHRACITE COAL	0	0	0	0	0		
2. BITUMINOUS COAL	0	0	0	0	0		
3. DISTILLATE OIL	0	0	0	0	0		
4. RESIDUAL OIL	0	0	0	0	0		
5. NATURAL GAS	0	0	0	0	0		
6. TOTAL	0	0	0	0	0		
D. TOTAL FUEL COMBUSTION	1,341	650	108	62	705		
II. PROCESS LOSSES							
A. AREA SOURCES	0	0	0	653	0		
B. POINT SOURCES	21,022	0	0	0	0		
III. SOLID WASTE DISPOSAL							
A. INCINERATION							
1a. ON SITE-AREA SOURCE	477	7	4,092	1,344	14	27,200	tons/yr.
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2. MUNICIPAL ETC.- POINT SOURCE	0	0	0	0	0		
B. OPEN BURNING							
1a. ON SITE-AREA SOURCE	0	0	0	0	0		
b. ON SITE-POINT SOURCE	0	0	0	0	0		
2a. DUMPS - AREA SOURCE	0	0	0	0	0		
b. DUMPS - POINT SOURCE	0	0	2	1	0		
C. CONICAL BURNERS - POINT SOURCE	0	0	0	0	0		
D. TOTAL SOLID WASTE DISPOSAL	477	7	4,094	1,345	14		
IV. TRANSPORTATION-AREA SOURCE							
A 1. MOTOR VEHICLES-GASOLINE	31	30	19,820	2,649	1,431	152,200	10^3V-M/yr.
2. MOTOR VEHICLES-DIESEL	2	3	20	4	21	121	10^3gal./yr.
B. OFF-HIGH FUEL USAGE							
1. DIESEL	0	0	0	0	0		
2. GASOLINE	0	0	0	0	0		
C. AIRCRAFT	8	7	37	5	7		
D. RAILROADS	7	17	19	13	20	537	10^3gal./yr.
E. GASOLINE HANDLING EVAP. LOSSES	0	0	0	127	0		
F. TOTAL TRANSPORTATION	48	57	19,896	2,798	1,479		
V. MISCELLANEOUS-AREA SOURCES							
A. AGRICULTURAL BURNING	0	0	0	0	0		
B. GRAIN ELEVATORS	0	0	0	0	0		
VI. GRAND TOTAL							
A. AREA SOURCE	581	64	24,028	4,831	1,635		
B. POINT SOURCE	22,327	650	70	47	563		
C. TOTAL	22,908	714	24,098	4,878	2,198		

*Includes emissions from combustion of sour gas primarily at oil refineries.

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III. AREA DESCRIPTION

Wyoming is the 9th largest state in the Union. Its 97,914 square miles are divided into four geographic regions. These are the Great Plains in the Southeast, the Black Hills in the Northeast, the Rockies in the West and between these regions the Intermountain Basin. The only farming area in Wyoming is in the Great Plains. The Rocky Mountains and the Black Hills are rich in mineral and petroleum deposits, but the Intermountain Basin is a desert area. The major industries are petroleum production and refining, uranium mining and reduction, soda ash production from Trona ore, and lumber production. The major agricultural product is livestock.

The meteorological data of the area show that it is a cool dry area with good ventilation. A 30 year record at Lander indicates mean maximum temperatures ranging from 31 degrees in January to 86 degrees in July. The corresponding mean minimum temperatures are 8 degrees in January and 55 degrees in July. Degree heating days within the state range from over 11,000 to less than 7200 depending on elevation. An average annual value, based on records from Casper, Cheyenne, Lander, and Sheridan, is 7564 degree heating days.

Casper, the most industrialized city in Wyoming, has an average wind speed of 13.3 miles per hour with 5 percent of the observations being calm, 8 percent being less than 4 miles per hour and 24 percent being less than 8 miles per hour. In contrast Los Angeles has an average wind speed of 6.8 miles per hour with 13 percent of the observations being calm, 28 percent being under 4 miles per hour and 63 percent being under 8 miles per hour.

Precipitation in Wyoming, by climatic region, ranges from 10 to 24 inches with the populated areas having 10 to 15 inches of precipitation annually.

IV. METHODOLOGY

A. DEFINITION OF POINT AND AREA SOURCES

This emissions inventory considers two classifications of emissions sources, point and area sources. Point sources are generally large establishments whose emissions are significant enough to warrant individual consideration. On the other hand, sources whose emissions are too small to be considered individually are accounted for collectively as an area source.

1. Point Sources

The Federal Register (Volume 36, No. 67, Part II, Appendix C) lists those major pollutant source categories which are to be classified as point sources, independent of size. Wyoming contains the following industrial categories which are included in the Federal listing:

Fertilizers
Feed and Grain Handling and Processing
Asphaltic Concrete Batching
Bricks and Related Clay Refractories
Cement
Concrete Batching
Rock, Gravel, and Sand Quarrying and Processing
Open Burning Dumps
Steam Electric Power Plants
Petroleum Storage Tanks
Petroleum Refining and Petrochemical Operations

In addition to the above industrial classifications, all fuel combustion sources were considered point sources if one or more of the following air pollution emission criteria were met:

- Annual Particulate Emissions of 5 tons or Greater
- Annual Sulfur Dioxide Emissions of 10 tons or Greater
- Annual Nitrogen Oxide Emissions of 25 tons or Greater
- Annual Carbon Monoxide Emissions of 25 tons or Greater
- Annual Hydrocarbon Emissions of 25 tons or Greater

2. Area Sources

Area sources are defined as those combustion and process sources which in themselves are too small to constitute a point source, but

when considered collectively, will significantly contribute to the total emissions of the study area.

The following presents a listing of those categories considered as area sources in Wyoming. These categories, however, exclude those individual sources which have emissions large enough to classify them as point sources.

Fuel Combustion Stationary Sources

- Residential heating - combustion of natural gas and some coal accounts for emissions from residential heating in Wyoming.
- Commercial, institutional and industrial space heating - area source emissions in this category result from the burning of natural gas and distillate oil. The coal and residual oil used in Wyoming in this category are essentially all accounted for by point sources.

Process Losses

- Dry cleaning establishments.
- Utilization of paints and varnishes.

Solid Waste Disposal.

- On Site Open Burning of Municipal Refuse.
- On Site Incineration of Municipal Refuse.

Transportation

- Motor Vehicles - both gasoline and diesel powered vehicles are included.
- Locomotives
- Aircraft
- Evaporative losses from gasoline marketing

B. POINT SOURCE

1. Data Collection

a. Preparation of Mailing List

Using the above definition of point sources in Wyoming, a mailing list was developed and questionnaires sent out. Table 8 presents a listing of references utilized in developing this mailing list.

TABLE 8

LISTING OF POINT SOURCE REFERENCES

1. Wyoming Directory of Manufacturing and Mining (1969) prepared by the Wyoming Department of Economic planning and development and the Wyoming Department of Labor.
2. Division of Medical Facilities Directory 1970-71 by the Wyoming Department of Public Health.
3. Wyoming Educational Directory 1970-71 by the Wyoming Education Department.
4. 28th Biennial Report of the Public Service Commission of Wyoming 1968-70.
5. Fortune Plant and Product Directory 1966 published by Fortune Magazine.
6. U. S. Chemical and Petroleum Plants 1965, Noyes Development Corp., 188 Mill Road, Park Ridge, New Jersey.
7. Market Statistics - Key Plants 1967, Market Statistics, Inc., New York, N. Y. 1968.
8. Steam Electric Plant Factors 1969, National Coal Assn. (Annual Report), Washington, D. C., HD9685 U4 N277.
9. U. S. Refineries, Where, Capacities, Types of Processing, 1970, Oil and Gas Journal.
10. Minerals Yearbook, Vol. II, Mineral Fuels, 1968, U. S. Department of Interior, Bureau of Mines, U. S. Government Printing Office, Washington, D. C.
11. Wyoming Division of Health and Medical Services.
12. Wyoming Division of Medical Facilities, Services and Medicare.
13. Wyoming Department of Education.
14. Utilities Department, Wyoming Public Service Commission.
15. Wyoming State Library.
16. Wyoming Department of Economic Planning and Development.
17. Wyoming Board of Equalization - Gasoline Sales and Use Tax Division.
18. Wyoming Board of Equalization - Commercial Vehicle Division.
19. Wyoming Board of Equalization - Registration and Dealers License Section.
20. Wyoming Commissioner of Public Lands.
21. Wyoming Highway Department Planning and Research Division.
22. U. S. Department of Commerce - Cheyenne Office.
23. U. S. Bureau of Land Management - Cheyenne Office.
24. Cheyenne Light, Fuel and Power Company.

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As discussed earlier, a fuel combustion source, other than specified in the Federal Listing of major industrial categories, was classified as a point source if its annual emission level for particulate, or SO_2 was equal to or greater than 5 or 10 tons, respectively, or if the CO, NO_x or hydrocarbon emissions were equal to or greater than 25 tons per year. In compiling this mailing list, however, there were several categories (such as schools, hospitals, hotels, a variety of residential, commercial, institutional, Federal and civic buildings, together with many miscellaneous industries) which, because of a lack of information pertaining to the type and quantity of fuel consumed, could not definitely be classified as point sources. Working criteria for the completion of the point source mailing list were then established and are presented below:

Manufacturing and Commercial Establishments	-	more than 25 employees
Schools and Colleges	-	more than 700 students
Hospitals	-	more than 100 beds.

These criteria were modified as required in the light of knowledge of either State or GCA personnel as well as data available from the individual sources.

b. Response to Questionnaires

A mailing list of 246 addresses was compiled by GCA to be contacted by the Industrial Hygiene Section of the State of Wyoming. In addition, one utility company was contacted directly by Region VIII of EPA to obtain the information required in the point source estimate form. Table 9 gives a review of the questionnaires sent out and the number and percent of returned forms. Copies of these questionnaires are presented in the appendix.

Table 9 shows that of the 247 questionnaires mailed, 61.5 percent were eventually completed and returned. A number of questionnaires were initially sent in incomplete or with erroneous information and a telephone recontacting effort was undertaken by the State of Wyoming so that these questionnaires could be properly completed.

In addition, the State also contacted selected point sources who failed to return their questionnaires.

TABLE 9

SUMMARY OF RESPONSE TO POINT SOURCE QUESTIONNAIRES

Type of Facility	Sent Out	Returned	Percent Returned
MANUFACTURING:			
Food and Kindred Products	14	11	79
Lumber and Wood Products Except Furniture	40	20	50
Printing, Publishing and Allied Industries	7	3	43
Chemicals and Allied Products	12	8	67
Petroleum Refining and Related Industries	12	10	83
Stone, Clay, Glass and Concrete Products	10	6	60
Fabrication, and Miscellaneous Manufacturing Industries	4	2	50
MINING:			
Metal Mining	14	12	86
Bituminous Coal and Lignite Mining	5	5	100
Crude Petroleum and Natural Gas	72	37	51
Mining and Quarrying of Nonmetallic Minerals, Except Fuels	26	19	73
Power Utilities	5	5	100
Nursing Homes and Hospitals	7	4	57
Schools and Colleges	19	10	53
TOTAL	247	152	61.5

2. Data Analysis

Analysis of the data from the completed questionnaires consisted of two essential phases: (a) the choice and use of a coordinate system for defining the locations of point sources, and (b) the transforming of raw data from the questionnaires into the form required for input to the computer program used by the Office of Air Programs (OAP) for the final emissions inventory calculations.

a. Coordinate System

The Universal Transverse Mercator (UTM) coordinate system was chosen for Wyoming because: (a) the system is widely used in meteorological modeling, (b) maps with the UTM grids denoted are readily available from the U. S. Geological Survey (USGC), and (c) the UTM system does not suffer from grid irregularities to the same extent as do most other systems, notably, the township/section system used in Wyoming. In general, the locations of individual point sources were determined to within one kilometer in either (flat projection) dimension.

b. Computer Input Forms

The details of the data manipulation required for data transformation will not be discussed here. Instead, some critical assumptions and statements of policy regarding data treatment will be reviewed in the following material.

1. Stack Parameters - information concerning stack heights, diameters, and flow conditions are given only for sources emitting 50 tons or more per year of any pollutant. In most cases where such data are given, they are based on estimates using OAP recommended procedures.

2. Process Weights - because sufficient data were not available from the questionnaires, maximum process weights were not estimated.

3. Fuel Characteristics - in almost all cases, these were given on the returned questionnaires. In those few cases where such data were not given, assumptions were made based on data from the returned questionnaires.

4. Pollution Control Efficiency - major point sources gave control efficiencies almost without exception, but many smaller sources did not have such data. The values given by McGraw and Duprey (Table 10, Ref. 11) were normally used where the data were missing.

5. Emissions - some respondents included estimates of actual emissions on their returned questionnaires. These data were used if they showed reasonable agreement with estimates obtained by the use of emission factors. Otherwise, the estimated values based on emission factors were used.

6. Allowable emissions - allowable emissions for particulate as defined by Wyoming law were hand calculated for all regulated point sources in the state. In addition, Federal model emissions were calculated for point sources within the city limits of Cheyenne, Laramie, and Casper. The Federal model sulfur dioxide emissions were calculated for combustion sources by assuming 80 percent removal.

At the request of EPA-Denver, and with concurrence of the Wyoming Department of Industrial Hygiene, State allowable particulate emissions are not included for any natural gas burning point sources.

7. Oil Field and Refinery Sumps and Flares - oil sumps resulting from cleaning the tanks in well fields are occasionally burned. In this operation, it is assumed that 50 percent of the oil is burned with the resulting SO_2 being estimated from the relationship:

$$SO_2 \text{ (pounds)} = 157\ S$$

where S is the percent sulfur in the crude oil. Particulates from the burning sumps are estimated to be 30 pounds per 1000 gallons of burned oil.

Gas burned in refinery and oil field flares is assumed to contain 1.0 percent sulfur unless otherwise stated. Hand calculated emissions are only made for SO_2 and no emission factors are available for the other contaminants. For all other gas burning point sources, estimates of SO_2 are made for all gas containing greater than

0.0005 percent sulfur. These estimates are included in the hand-calculated emissions in addition to providing an emission factor to the combustion process. This is done because there is no provision in the computer program to estimate SO_2 from a source burning sour (high sulfur) natural gas.

All flares, boilers, heaters, treaters, and engines in oil well operations have an SIC Code of 2911, process code 00, and a type code of 02. A distinction is made between engines in the emission factor assigned to the fuel consumption.

C. AREA SOURCES

1. References

References used to compile data for the consumption and apportionment of area source fuel, solid waste and evaporative losses in Wyoming are summarized in Table 10. These references include both local and state data together with data compiled by private companies and by Federal agencies such as the Census Bureau, Bureau of Commerce and the Bureau of Mines.

2. Data Analysis

This section discusses the methodology utilized in estimating and apportioning fuel, solid waste and process area source emissions. Because a variety of area source categories utilize a number of different types of fuels, we have included Table 11 which summarizes those fuel consuming area source categories and the types of fuels utilized. The ensuing discussion of stationary fuel combustion and transportation area sources is based around this table.

a. Stationary Fuel Combustion

i. Coal

The Bureau of Mines[25] has published data for annual coal consumption in Wyoming (3,809,000 tons) which is in excellent agreement (within 3%) with the total coal consumed by point sources in the state (3,668,053 tons). There are, however, some small users of resi-

TABLE 10

AREA SOURCE REFERENCES FOR WYOMING

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26. Personal Communication, Frances Schofield, U. S. Paint and Varnish Assoc., Washington, D. C., June 21, 1971.

27. 1968 LP Gas Shipment Up 11.7 Percent, LP Gas, December 1969, Page 30.

TABLE 11

AREA SOURCE CATEGORY VS. FUEL TYPE CONSUMED

Area Source Fuel Combustion Categories	Fuel Type							
			DISTILLATE					
	Coal	Residual Oil	Kerosene	Diesel	#1,2,& #4 Oil	Natural Gas	Gasoline	LPG
Stationary Sources								
Residential	X	0	0	NA	X	X	NA	X
Commercial & Institutional	0	0	X	NA	X	X	NA	X
Industrial	0	0	X	NA	X	X	NA	0
Transportation								
Railroads	NA	X	NA	X	NA	NA	NA	NA
Motor Vehicles	NA	NA	NA	X	NA	NA	X	NA
Aircraft	NA	NA	X	NA	NA	NA	X	NA

X = fuel is utilized by source category
0 = fuel is not utilized by source category
NA = not applicable

dential coal (22,100 tons) in two counties in the State. We have, therefore, concluded that most coal consumption in Wyoming is accounted for by point sources, and that area source coal consumption is small, limited to the two counties utilizing coal for residential heating. This is confirmed by communications with various state officials and coal producers familiar with coal usage in Wyoming.

ii. Residual Oil

Returned questionnaires indicate that residual oil consumed annually by point sources (38,422,000 gallons) significantly exceeds the Bureau of Commerce[3] consumption total for Wyoming (2,406,000 gallons). This difference reflects the heavy use of residual oil by oil related industries which likely consume significant quantities of oil produced at their plant. The residual oil consumed by point sources, excluding these oil related industries (3,654,000 gallons), however, is in good agreement with the Bureau of Commerce consumption total, considering that the Bureau of Commerce data are for the year 1967. We have, therefore, concluded that residual oil consumption in Wyoming was accounted for by point sources and that area source consumption is essentially zero. This is confirmed by communications with various state officials familiar with residual oil usage in Wyoming.

iii. Distillate Oil

Area source distillate oil consumption for space-heating in Wyoming is insignificant due to the widespread use of natural gas. This has been established by communications with various state and local personnel intimately familiar with fuel consumption patterns in Wyoming. In addition, further verification is given by the Bureau of Commerce[3] annual consumption total for distillate oils (~ 26,000,000 gallons) which is substantially lower than the combined point source (~ 15,000,000 gallons) and diesel fuel (~ 50,000,000 gallons) annual distillate consumption totals for Wyoming.

The quantity of kerosene utilized annually in Wyoming (967,000 gallons) was determined from the 1967 Census of Business.[3]

This kerosene was considered to be fuel for commercial and institutional space heating and was apportioned by county according to the volume sales statistics published in the above reference. Emissions were calculated based upon the emission factors for industrial and commercial distillate fuel oil as presented by McGraw and Duprey.[11]

iv. Natural Gas

Total natural gas purchased from utility companies in Wyoming in 1969 ($61,459 \times 10^6$ SCF) was reported by the Public Service Commission.[23] From this total, the natural gas purchased by point sources ($29,570 \times 10^6$ SCF) from utilities (including natural gas used as a raw material feed stock in the manufacture of urea and liquid petroleum products) was subtracted to obtain the natural gas utilized in the state for residential, commercial, institutional and industrial space heating ($31,900 \times 10^6$ SCF). Natural gas consumption in Laramie County as provided by Cheyenne Light, Fuel and Power Co., indicates that the fuel used for residential space heating is about equal to the fuel used in commercial, institutional and industrial units. Therefore, gas consumption for space heating by commercial, institutional and industrial units was assumed to be the same as for residential units ($\sim 16,000 \times 10^6$ SCF).

As an alternative technique, area source natural gas consumption was also estimated using the following relationship as described by Bierbaum and Gedgaudas.[1]

$$\text{Total Gas Usage} = (\text{D.U.}) \times \left[\frac{22.5\ \text{ft}^3}{\text{D.U.-deg day}}\right] \times (\text{deg days})$$

where D.U. is dwelling units and degree days represent the average heating degree days.

The resulting value using this technique ($16,700 \times 10^6$ SCF), and multiplying by two to obtain residential plus commercial, institutional and industrial ($33,400 \times 10^6$ SCF) checked well (within 5 percent) with the alternative approach. These statewide consumption totals were apportioned to the counties and cities (Cheyenne, Casper and Laramie) by population.

Emissions were calculated based upon the emission factors presented by McGraw and Duprey.[11]

v. Liquid Petroleum Gas

The state consumption total (69,918,000 gallons) was obtained from the Bureau of Mines[27] and apportioned by population data to the three Federal Air Quality Control Regions and the cities of Cheyenee, Laramie and Casper. Emissions were calculated based upon the emission factors for domestic and commercial propane as presented by McGraw and Duprey.[11] The emission factor for nitrogen oxide was assumed to be 23 pounds per thousand gallons, based on the assumption that 80 percent LPG was utilized by domestic sources and 20 percent by commercial sources.

The emissions from LPG combustion appear in Tables 2-7 which summarize emissions for the 3 Air Quality Control Regions and the urban areas of Cheyenne, Laramie and Casper. However, because the emissions from LPG combustion are small, they were not included in the area source emissions in the accompanying computer printout.

b. Transportation

i. Gasoline Powered Motor Vehicles

Emissions from gasoline powered motor vehicles were calculated using the vehicle mile method described by Bierbaum and Gedgaudas, Air Pollutant Emission Inventory Techniques, 1969.[1] The emission factors developed by this method are presented in Table 16 of this text and a sample calculation is shown in the appendix. Daily vehicle mile data for each county in the State of Wyoming were obtained from the Planning and Research Division of the Wyoming State Highway Department. These data were provided for 6 classes of roads for local, foreign and commercial traffic. The following estimates of the average vehicle speed for each class of road were also obtained from the Wyoming State Highway Department.

Road Type	Road Class	Average Vehicle Speed
Federal Aid Interstate Road	01,02	60 mph
Federal Aid Primary Road	03,04	45 mph
Federal Aid Secondary Roads	05,06,07,08	45 mph

Road Type	Road Class	Average Vehicle Speed
State Roads	09,10	24 mph
Local Rural Roads	11	18 mph
Local Urban or Municipal Roads	12	10 mps

The ratio of vehicles registered in the State of Wyoming by year of manufacture were obtained from the Albany County Motor Vehicle Registration Office. The registration of 2092 vehicles was selected from approximately 11,000 registrations and the proportions of automobiles by year of manufacture calculated.

1963 or older	23.6 percent
1964 through 1967	42.1 percent
1968 through 1970	34.3 percent

The method of estimating NO_X emissions from automobiles described by Bierbaum (1969)[1] was modified to include the effects of the altitude of the State as described by R. L. Duprey, Compilation of Air Pollution Emission Factors, 1968.[6] The average altitude for the State was considered to be approximately the same as Denver, Colorado; therefore, the NO_X correction factors given by Duprey for Denver were used.

Table A in the Appendix shows the daily vehicle miles by road class for each county. Also, Tables B, C, and D present the daily emissions by road class, for each county in Wyoming.

ii. Diesel Powered Motor Vehicles

The emissions from diesel powered motor vehicles were calculated from the vehicle mile data obtained from the Wyoming State Highway Department.[24] The State Highway Department estimates that 80 percent of all traffic classified commercial in the Wyoming Traffic Data Book for 1970 were propelled by diesel engines. The method used to calculate emissions for diesel powered vehicles is described by Bierbaum (1969).[1]

Table E in the Appendix presents diesel fuel consumption (vehicle-miles and gallons of diesel fuel) by county.

iii. Railroads

The estimates of diesel fuel used by railroads in the State of Wyoming were obtained from:

- The Union Pacific Railroad
- The University of Wyoming

The Union Pacific Railroad reported their own estimates of the diesel fuel they consumed in the State by county. The fuel used by the Burlington and Northern Railroad was estimated to be 25 percent of that used by Union Pacific Railroad by Professor Stillwell of the Petroleum Engineering Department of the University of Wyoming.

Table F in the Appendix summarizes the fuel consumption of these two railroads by county. Included in this table is a comparison between the Burlington Northern consumption totals as estimated by Professor Stillwell and as reported by Burlington Northern. The figures from Burlington Northern were received too late to be utilized in this study.

iv. Aircraft

Airport operations data were obtained from the Wyoming State Highway Department. Total landing and takeoff operations were tabulated for each major airport, as well as the type of equipment. Emissions were calculated using the method described by McGraw and Duprey.[11] Table G in the Appendix shows the number of annual aircraft operations in Wyoming.

v. Gasoline Marketing

The emission of hydrocarbons due to gasoline marketing was estimated using the method described by M. J. McGraw and R. L. Duprey, Compilation of Air Pollutant Emission Factors, 1971.[11] Gasoline sales for each county were obtained from the Wyoming State Revenue Department and the emission calculated based upon 21 pounds of hydrocarbons for each 1000 gallons of gasoline sold.

c. Solid Waste Disposal

The State of Wyoming recently compiled information on the quantity of refuse collected and the handling and treatment procedures

for each municipal dump and sanitary landfill in the state. Those dumps which practiced open burning were included as point sources. In assuming that 7 lbs./person per day of mu cipal refuse (which includes household, commercial and institutional refuse) is generated, the total refuse which remains uncollected can be estimated for each county by simply subtracting the refuse collected from the quantity generated. The uncollected refuse was assumed to be disposed of in backyard single chamber incinerators without primary burners which are in wide use in Wyoming. The emission factors of McGraw and Duprey (1971) were assigned to these incinerators. A summary of annual solid waste disposal is presented in Table H of the Appendix.

d. Process Losses

i. Dry Cleaning

McGraw and Duprey[11] have estimated that hydrocarbon emissions from dry cleaning operations in cold climates such as that of Wyoming average 2.7 pounds per person per day. This value was used for the determination of emissions from this source for the counties and the major urban areas of Wyoming.

ii. Surface Coating Operations

This category includes chiefly the application of paints and varnishes for protective and/or decorative purposes. No state surface coating consumption data were available for Wyoming, but a national total for paint and varnish was obtained from the U. S. Paint and Varnish Association [26]. From this total and the national population, it was determined that per capita consumption of paint and varnish is 0.0248 tons/person per year. This value was used with North Dakota population data[2] to determine the paint and varnish used in the pertinent geographical areas in the state. Information from the Paint and Varnish Association [26] indicated that the solvent content of these coatings averaged about 62.5 percent. In determining the hydrocarbon emissions from solvent evaporation, it was assumed that all of the solvent was hydrocarbon and that it all evaporated.

V. COMPUTER PRINTOUT

The detailed results of the emissions inventory are given in the computer printout which is forwarded in a separate binder.

The printout is arranged by Air Quality Region, and for each Region, there is a point source printout and an area source printout. The point source printout presents detailed data and also summaries of annual emissions by source category for each Political Jurisdiction (county) within the Region; these summaries are tabbed, "#8". Similarly, the area source printout presents detailed data and also summaries of annual emissions by source category for each Political Jurisdiction (county) within the Region; these summaries are tabbed, "#18".

Detailed notes on the data provided in the printout are now presented. These are arranged to follow the sequence of the printout sheets and should be read in conjunction with general explanations given in the Methodology section of this report. Numbered tabs are attached to the printout pages to indicate the first page of each listing.

A. POINT SOURCE PRINTOUT

Listing #1

The table presented correlates the emission factor set numbers shown in Listing #4 to the emission factors used in the computer-calculated emissions.

Listing #2

Standard Industrial Classifications and Process Codes were assigned to each source as shown in Table 12. Where more than one source had the same classification and Process Code, consecutive Site numbers were assigned to such sources.

The counties corresponding to the Political Jurisdiction numbers listed are shown in Table 13.

TABLE 12

STANDARD INDUSTRIAL CLASSIFICATION (SIC) NUMBERS AND ASSOCIATED PROCESS CODES

The source type identification code scheme used in this table is composed of the following sets of numbers:

A four-digit Standard Industrial Classification (SIC) code, XXXX, which identifies the nature of the industry.

A two-digit process code, XX, which provides the process classification.

A zero in the second location of the process code (XO) indicates a fuel combustion source. In this case, the first digit (X) identifies the fuel burner type (as defined below).

The fuel burner types defined by the process codes 00, 10, 20, ... 90 are defined as follows:

00. All types not listed
10. Pulverized, General
20. Pulverized, Dry Bottom
30. Wet Bottom without Flyash Reinjection - Pulverized
40. Pulverized, Wet Bottom with Flyash Reinjection
50. Cyclone
60. Spreader Stoker without Flyash Reinjection
70. Spreader Stocker with Flyash Reinjection
80. All other Stokers
90. Hand Fired

****

SOURCE TYPES FOUND IN WYOMING

2011 MEAT PACKING PLANTS

XO. Combustion
01. General

2029 DAIRY PRODUCTS

XO. Combustion
01. General

Table 12 (continued)

SOURCE TYPES FOUND IN WYOMING

2041 FLOUR AND OTHER GRAIN MILL PRODUCTS

- XO. Combustion
- 01. General
- 02. Wheat
- 03. Barley

2099 FOOD PREPARATIONS, NOT ELSEWHERE CLASSIFIED

- XO. Combustion
- 01. General

2751 COMMERCIAL PRINTING, EXCEPT LITHOGRAPHY

- XO. Combustion
- 01. General

2818 INDUSTRIAL ORGANIC CHEMICALS, NOT ELSEWHERE CLASSIFIED

- XO. Combustion
- 01. General

2819 INDUSTRIAL INORGANIC CHEMICALS, NOT ELSEWHERE CLASSIFIED

- XO. Combustion
- 01. Sulfur Recovery Incinerator
- 02. Sulfuric Acid
- 03. Nitric Acid
- 04. Ammonium Nitrate
- 05. Hydrofluoric Acid
- 06. Calcium Carbide - Coke Dryer
- 07. Calcium Carbide - Electric Furnace Hood
- 08. Calcium Carbide - Electric Furnace Vents
- 09. Calcium Carbide - Stack
- 10. Calcium Carbide - Calcination
- 11. Phosphoric Acid

2871 FERTILIZERS

- XO. Combustion
- 01. General

Table 12 (continued)

2899 CHEMICALS AND CHEMICAL PREPARATIONS, NOT ELSEWHERE CLASSIFIED

XO. Combustion
01. General

2911 PETROLEUM REFINING

XO. Combustion
01. Fluid Catalytic Units
02. Moving Bed Catalytic Units
03. Sulfur Recovery
04. Acid Refining of Lube Oils

2951 ASPHALT BATCHING

XO. Combustion
01. Batching
02. Quarrying
03. Rock Drying
04. Sheet Rock Cutting and Trimming

2999 PRODUCTS OF PETROLEUM AND COAL, NOT ELSEWHERE CLASSIFIED

XO. Combustion
01. General

3241 CEMENT, MANUFACTURING

XO. Combustion
01. Dry Process
02. Wet Process
03. Sand Dryer

3251 BRICK AND STRUCTURAL CLAY

XO. Combustion
01. General

3273 READY-MIXED CONCRETE

XO. Combustion
01. General

3295 MINERALS AND EARTH, GROUND OR OTHERWISE TREATED

XO. Combustion
01. Crushing
02. Conveying, Screening and Shaking
03. Storage Piles

Table 12 (continued)

4911 ELECTRIC COMPANIES AND SYSTEMS

XO. Combustion

4953 REFUSE SYSTEMS

XO. Combustion (fuel)
01. Municipal Incinerator
02. Open Burning
03. On-Site Multichamber Incinerator
04. On-Site Single Chamber Incinerator
05. Flue-fed Incinerator
06. Other

8221 COLLEGES, UNIVERSITIES, AND PROFESSIONAL SCHOOLS

XO. Combustion

TABLE 13

JURISDICTIONS INCLUDED WITHIN AIR QUALITY CONTROL REGIONS IN WYOMING

Casper Intrastate Air Quality Control Region - 241

In the State of Wyoming:

1. Converse County
2. Fremont County
3. Natrona County

Metropolitan Cheyenne Intrastate Air Quality Control Region - 242

In the State of Wyoming:

1. Albany County
2. Goshen County
3. Laramie County
4. Platte County

Wyoming Intrastate Air Quality Control Region (remaining area) - 243

In the State of Wyoming:

1. Big Horn County
2. Campbell County
3. Carbon County
4. Crook County
5. Hot Springs County
6. Johnson County
7. Lincoln County
8. Niobrara County
9. Park County
10. Sheridan County
11. Sublette County
12. Sweetwater County
13. Teton County
14. Uinta County
15. Washakie County
16. Weston County

Note: Yellowstone National Park included within Park and Teton counties.

Each source was classified by Type as either Process, Boiler or Solid Waste. All fuel combustion sources were classified as Boiler although these included a small number of process combustion sources such as kilns, flares and burning of petroleum sludge.

Listing #3

The Shifts/Day figure is based on the ratio of the reported total operating hours to 8760 (total hours in a year).

The Use Factor figure is based on the ratio of maximum capacity to actual average operating rate. In the case of fuel combustion sources, average operating rate is the ratio of reported annual BTU consumption to reported annual hours operated.

The maximum and normal Process Weight Rates are expressed in pounds per hour.

Listing #4

This listing is self-explanatory and no further comments will be included here.

Listing #5

This listing gives the totals of fuels consumed during the year within the Region.

Listing #6

Computer calculated emissions were made for fuel combustion sources only, using the fuel totals and emission factor set numbers indicated. Solid Waste and Process sources were hand calculated. In addition, emissions from the combustion of sour gas and the open burning of petroleum sludge were hand calculated. These hand calculations were based on annual solid waste, process, and combustion totals together with emission factors from McGraw and Duprey (Table 10, No. 11).

The Uncontrolled figure is the sum of the computer calculated and hand calculated figures.

The Controlled figure is the uncontrolled figure minus the product of the Control Efficiency and the uncontrolled figure.

The Device Identification number corresponds to the control device listed in Table 14 of this report.

The Allowable particulate emission values are those permitted by the State of Wyoming. There are no state values for allowable SO_2 emissions.

Listing #7

The same notes apply as for Listing #6, except that no control devices or allowable emissions are considered.

Listing #8

This listing gives total point source emissions for each Political Jurisdiction within the Region. The totals are presented by source category and fuel totals are included for combustion sources. The industrial-commercial-institutional fuel combustion category marked "other" is comprised of emissions from the combustion of sour gas in both oil refineries and industry, and the open burning of petroleum sludge in oil refineries.

Refuse totals are also presented for each of the solid waste categories. The solid waste category marked, "other" is comprised of conical burners which consume wood scrap from lumber and saw mills.

Listing #9

The Allowable emissions of particulate and SO_2 based on the Federal model standards as published in the Federal Register, Volume 36, Number 67, on Wednesday, April 7, 1971, are presented for all regulated point sources in Wyoming.

The zone numbers specify whether the point source is located in zone 12 or zone 13 of the Universal Transverse Mercator (UTM) coordinate system.

TABLE 14

POLLUTION REDUCTION DEVICES OR METHODS

001	Wet Scrubber - High Efficiency
002	Wet Scrubber - Medium Efficiency
003	Wet Scrubber - Low Efficiency
004	Gravity Collector - High Efficiency
005	Gravity Collector - Medium Efficiency
006	Gravity Collector - Low Efficiency
007	Centrifugal Collector - High Efficiency
008	Centrifugal Collector - Medium Efficiency
009	Centrifugal Collector - Low Efficiency
010	Electrostatic Precipitator - High Efficiency
011	Electrostatic Precipitator - Medium Efficiency
012	Electrostatic Precipitator - Low Efficiency
013	Gas Scrubber
014	Mist Eliminator - High Velocity
015	Mist Eliminator - Low Velocity
016	Fabric Filter - High Temperature
017	Fabric Filter - Medium Temperature
018	Fabric Filter - Low Temperature
019	Catalytic Afterburner
020	Catalytic Afterburner with Heat Exchanger
021	Direct Flame Afterburner
022	Direct Flame Afterburner with Heat Exchanger
027	Eliminate Coal Combustion
028	Eliminate Coal and Residual Fuel Oil Combustion
029	Change all Fuel Use to Natural Gas
030	No Fuel Use Over a Maximum Sulfur Content (Specified by the User in the Regional Data Base)
031	Same as Device 030 but with a Different Allowable Sulfur Content
039	Catalytic Oxidation - Flue Gas Desulfurization
041	Dry Limestone Injection
042	Wet Limestone Injection
043	Sulfuric AcidPlant - Contact Process
044	Sulfuric Acid Plant - Double Contact Process
045	Sulfur Plant

Additional information includes comments helpful in clarifying the location of each of the point sources.

B. AREA SOURCE PRINTOUT

Listings #10, #11, #12, #13, #14

Each listing presents emissions of one pollutant by Political Jurisdiction and consists of four printout tables. Emissions entitled, "Apportioned Emissions" (Table 1), and "Calculated Emissions", (Table 2) were computer calculated and based on emission factors presented below in Table 15 of this report. Note that in Table 2 of the printout, the columns marked "Diesel Motor Vehicles," and "Motor Vehicles 25 MPH and 45 MPH," have zero emissions since these categories are included in Table 3 of the printout.

Table 3 of the printout, entitled, "Additional Emissions" was hand calculated. The basis for these hand calculations has been discussed in the Methodology Section (IV) of this report. Note that the explanation to the row numbers in Table 3 of the printout are presented below in Table 16 of this report.

Table 4 of the printout sums up the emissions from the preceding 3 tables. "Calculated 1" refers to Table 1; "Calculated 2" refers to Table 2, and "additional" refers to Table 3.

All emissions in these four tables are expressed in Tons per Year.

Listing #15

Printout Table 5 shows only the computed-calculated emission and fuel consumption totals for the Region. The source categories and appropriate units for the fuel totals corresponding to rows 1 through 22 are presented below in Table 15. All emissions are expressed in Tons per Year. Total area source emissions are summarized in Listing #18.

Listing #16

Tables 6-1 and 6-2 of the printout show the factors utilized to apportion each of the 22 fuel totals (see Listing #15) to the Political Jurisdictions in the Region. Note that the column headings 1 through 11 in Table 6-1 correspond to numbers 1 through 11 in Table 15 of this report

TABLE 15

AREA SOURCE EMISSION FACTORS

NO.	AREA SOURCE CATEGORY	FUEL UNITS	EMISSION FACTORS (lbs./unit of fuel) PARTIC-ULATE *	SO_2 **	CO	HYDRO-CARBONS	NO_X
1	Residential Coal	Tons/year	2(A)	38(S)	50	12	5
2	Residential Oil	10^3gallons/year	10	144(S)	5	3	12
3	Residential Natural Gas	10^6cu.ft./year	19	0.6	20	8	75
4	Commercial & Institutional Coal	Tons/year	5(A)	38(S)	50	12	5
5	Commercial & Institutional Residual Oil	10^3gallons/year	23	159(S)	0.2	3	60
6	Commercial and Institutional Distillate Oil	10^3gallons/year	15	144(S)	0.2	3	60
7	Commercial & Institutional Natural Gas	10^6cu.ft./year	19	0.6	20	8	75
8	Industrial Coal	Tons/year	13(A)	38(S)	2	1	15
9	Industrial Residual Oil	10^3gallons/year	23	159(S)	0.2	3	60
10	Industrial Distillate Oil	10^3gallons/year	15	144(S)	0.2	3	60
11	Industrial Natural Gas	10^6cu.ft./year	18	0.6	0.4	40	175
12	Wood	Tons of wood/year	27	1.5	2	2	10
13	Open Burning	Tons of refuse/yr.	16	1	85	30	6
14	Incineration (dom. single chamber without primary afterburner)	Tons of refuse/yr.	35	0.5	300	100	1
15	Solvent Evaporation of Paints and Varnishes	Tons of solvent/yr	0	0	0	2000	0
16	Diesel Vessels	10^3gallons/year	25	144(S)	65	50	73
17	Railroads	10^3gallons/year	25	65	70	50	75
18	Diesel Motor Vehicles	10^3gallons/year	25	45	325	65	340
19	Not Applicable						
20	Urban Gasoline Motor Vehicles***						
21	Rural Gasoline Motor Vehicles***						
22	Not Applicable						

* Particulate emissions from coal combustion obtained by multiplying appropriate factor by percent of ash in coal.

** SO_2 emissions from coal, distillate oil and residual oil combustion obtained by multiplying appropriate factor by percent sulfur in fuel. For distillate oil, the percent sulfur was assumed to equal 0.75%.

*** See Table 16.

TABLE 16

ADDITIONAL EMISSIONS

No.	Category		Units	Emission Factors (lbs/unit)***				
				Particulate	SO_2	CO	Hydrocarbons	NO_x****
1	Gasoline Motor Vehicles**	60 mph	10^3 v-m per year	0.8	0.6	75	7.0	8.5
		45 mph		0.8	0.6	100	8.5	8.5
		24 mph		0.8	0.6	170	13	8.5
		18 mph		0.8	0.6	210	15	8.5
		10 mph		0.8	0.6	350	23	8.5
2	Diesel Motor Vehicles		10^3 gal/year	110	40	60	136	222
3	Aircraft	Piston Light	Engine-LTO/yr*	0.2	2	12	0.4	0.2
		Turbofan-med. range	Engine-LTO/yr*	7	2	16	50	7
		Turboprop	Engine-LTO/yr*	6	1	2	3	5
4	Dry Cleaning		Population	0	0	0	2.7	0
5	Gasoline Marketing		10^3 gal/year	0	0	0	21	0
7-15	Not Applicable							

*Engine-LTO cycle = engine landing-takeoff cycle.

**Refer to Methodology Section (IV-C-2).

***Adjusted to account for age distribution of cars by techniques described in Pierbaum (Table 10, #1).

****Adjusted to account for altitude as described in Duprey (Table 10, #6).

and that column headings 1 through 11 in Table 6-2 correspond to numbers 12 through 22 also of Table 15. Table 17 of this report indicates the units of these apportioning factors.

Listing #17

Tables 6-3 and 6-4 present the apportioned fuel totals in each Political Jurisdiction for each of the 22 source categories presented in Listing #15. Again, column headings 1 through 11 in Table 6-3 correspond to numbers 1 through 11 of Table 15 above. Column headings 1 through 11 in Table 6-4 correspond to numbers 12 through 22 of Table 15.

Listing #18

This listing presents total area source emissions for each Political Jurisdiction within the Region. The totals are presented by source category. The explanation of "additional Pollutant" numbers 1-15 are found above in Table 16 of this report.

The fuel total units are the same as those presented above in Table 15 of this report.

All emissions are expressed in Tons per Year.

TABLE 17

UNITS FOR FACTORS (IN LISTING #16 OF PRINTOUT) UTILIZED TO APPORTION AREA SOURCE EMISSIONS BY COUNTY

Column Heading	Units of Apportioning Factors
1	1000's of Tons
2	1000's of Gallons
3	10^6 standard cu feet
4	1000's of Tons
5	1000's of Gallons
6	1000's of Gallons
7	10^6 standard cu feet
8	--
9	--
10	--
11	--
12	--
13	--
14	tons/year
15	Tons of paint and varnish/year
16	--
17	1000's of gallons/year
18	--
19	--
20	--
21	--
22	--

APPENDIX

Sample Calculation of Automotive Emissions

The percentages of total hydrocarbon emissions for controlled and uncontrolled vehicles as presented by Bierbaum are:

	Uncontrolled	1963 Controls	1968 Controls
Exhaust	48%	63%	39%
Crank Case	30%	8%	0%
Fuel and Carburetor	22%	29%	61%

The following equations show the method used to determine the emissions from gasoline-powered motor vehicles:

SO_x

$$\text{Daily } SO_x \text{ Emissions} = \frac{\text{Daily Vehicle Miles}}{1000} \times 0.6 \text{ lb of } SO_x$$

Particulates

$$\text{Daily Particulate Emissions} = \frac{\text{Daily Vehicle Miles}}{1000} \times 0.8 \text{ lb of particulates}$$

NO_x

$$\text{Daily } NO_x \text{ Emissions} = \frac{\text{Daily Vehicle Miles}}{1000} \times 8.5 \text{ lb of } NO_x$$

Hydrocarbons

The hydrocarbons from the exhaust emissions (H_e) of gasoline-powered vehicles are:

$$H_e = \sum_{s=1}^{5} \left(\sum_{y=1}^{3} DVM_s \times A_y \times E_y \right)$$

where DVM_s is the daily vehicle miles for a given vehicle speed, s = 1, 10 mph; s = 2, 18 mph; s = 3, 24 mph; s = 4, 45 mph; s = 5, 60 mph; A_y is the percentage of the vehicle population in an age category (y), and E_y is the exhaust emissions

factor for the age category (y), y = 1, 1962 or older; y = 2, 1963 to 1967; y = 3, 1968 to 1970. The hydrocarbon emission factors for the various speeds are given in Table 16 of the Appendix. The hydrocarbon emissions from the crank case and evaporation are calculated on the basis of their relationship as given in the above table.

$$\text{Daily Crank Case Hydrocarbon Emissions} = \sum_{y=1}^{3} \frac{H_e F_{cy}}{F_{ey}}$$

$$\text{Daily Evaporative Hydrocarbon Emissions} = \sum_{y=1}^{3} \frac{H_e F_{fy}}{F_{ey}}$$

where H_e is the total hydrocarbon emissions from exhaust; F_{cy} is the percentage of hydrocarbon emissions from crank cases for a given control year (y); F_{ey} is the percentage hydrocarbon emissions from exhaust for a given control year (y); and F_{fy} is the percentage of hydrocarbon emissions from evaporation.

CO

The carbon monoxide emissions from gasoline-powered motor vehicles is calculated from:

$$\text{Daily Carbon Monoxide Emissions} = \sum_{s=1}^{5}\left(\sum_{y=1}^{3} DVM_s \times A_y \times C_y\right)$$

where DVM_s is the daily vehicle miles for a given vehicle speed, s = 1, 10 mph; s = 2, 18 mph; s = 3, 24 mph; s = 4, 45 mph; s = 5, 60 mph; A_y is the percentage of the vehicle population in an age category (y); and C_y is the CO emissions factor for the age category, y = 1, 62 or older; y = 2, 63 to 67; y = 3, 68 to 70. The CO emission factors are given in Table 16.

TABLE A

DAILY VEHICLE MILES BY ROAD CLASS*

County	Road Class and Speed						
	01, 02 Interstate (60 mph)	03, 04 Primary (45 mph)	05 to 08 Secondary (45 mph)	09, 10 State (24 mph)	07 (24 mph)	11 (18 mph)	12 (10 mph)
Converse	123,794	71,903	8,655	---	3,400	24,472	17,874
Fremont	---	370,615	60,855	---	900	66,230	74,816
Natrona	119,887	277,208	32,046	9,441	3,086	52,633	183,027
Albany	182,733	139,006	66,419	323	2,940	40,078	58,901
Goshen	---	143,966	34,944	---	2,926	34,967	32,145
Laramie	370,000	144,312	53,777	1,317	429	59,386	167,249
Platte	140,751	30,683	19,179	---	1,306	27,122	20,186
Big Horn	---	147,513	34,540	---	648	36,195	33,336
Campbell	97,909	63,412	47,121	---	---	29,588	21,556
Carbon	241,608	136,316	63,478	1,001	1,037	43,944	41,950
Crook	69,813	45,574	20,245	---	1,635	25,314	11,767
Hot Springs	---	70,153	6,361	96	1,656	7,434	17,874
Johnson	145,731	47,724	16,234	---	1,726	113,721	15,373
Lincoln	---	189,677	12,244	---	2,806	22,619	25,559
Niobrara	---	94,778	6,067	---	605	17,145	10,463
Park	---	183,021	40,987	25	395	54,068	47,320
Sheridan	81,703	70,782	62,612	---	3,890	23,948	52,328
Sublette	---	82,539	12,809	---	1,460	24,598	10,556
Sweetwater	466,793	101,044	62,154	---	5,224	44,116	50,284
Teton	---	140,844	23,275	---	---	20,036	9,901
Uinta	161,922	33,764	21,902	---	729	17,855	21,022
Washakie	---	85,934	12,997	54	2,007	16,405	24,912
Weston	---	90,109	10,481	---	---	27,057	22,225
(Yellowstone)	---	---	---	---	---	243,088	---

*Source: Wyoming Traffic 1970, Wyoming State Highway Department.

TABLE B

DAILY HYDROCARBON (POUNDS) EMISSIONS BY ROAD CLASS

County	Road Class and Speed					
	01, 02 Interstate (60 mph)	03 to 08, Primary/Secondary (45 mph)	09, 10 State (24 mph)	07 (24 mph)	11 (18 mph)	12 (10 mph)
Converse	1,233.6	870.1	--	62.9	522.5	585.2
Fremont	--	4,484.5	736.4	16.7	1,414.2	2,449.5
Natrona	1,194.7	3,742.1	174.9	57.1	1,123.9	4,519.2
Albany	1,820.9	2,485.6	6.0	48.3	855.7	1,928.4
Goshen	--	2,164.8	--	54.1	746.7	1,052.5
Laramie	3,686.0	2,396.8	24.4	7.9	1,268.1	5,476.1
Platte	1,502.7	603.3	--	24.0	579.3	661.0
Big Horn	--	2,202.7	--	12.0	772.8	1,091.5
Campbell	975.6	1,337.5	--	--	631.8	705.7
Carbon	2,407.6	2,417.4	18.5	19.3	938.3	1,373.6
Crook	695.7	796.3	--	30.1	540.5	385.3
Hot Springs	--	926.0	--	30.8	158.7	585.2
Johnson	1,452.2	773.8	--	31.8	293.0	503.3
Lincoln	--	2,443.3	--	52.1	482.9	836.7
Niobrara	--	1,220.3	--	11.3	365.2	342.6
Park	--	2,710.6	0.4	7.4	1,154.6	1,549.4
Sheridan	814.2	1,613.9	--	72.0	511.4	1,713.2
Sublette	--	1,153.7	--	27.2	565.3	345.6
Sweetwater	4,651.5	1,974.6	--	96.6	942.1	1,583.3
Teton	--	1,985.9	--	--	427.8	323.9
Uinta	1,613.5	673.6	--	13.4	381.3	688.4
Washakie	--	1,197.1	0.8	37.2	350.4	815.6
Weston	--	1,217.1	--	--	577.9	727.7
(Yellowstone)	--	--	--	--	5,190.6	--

TABLE C

DAILY CO (POUNDS) EMISSIONS BY ROAD CLASS

County	Road Class and Speed					
	01, 02 Interstate (60 mph)	03 to 08, Primary/Secondary (45 mph)	09, 10 State (24 mph)	07 (24 mph)	11 (18 mph)	12 (10 mph)
Converse	7,692.2	6,674.3	--	478.9	4,257.8	5,183.0
Fremont	--	35,747.3	--	126.8	11,523.0	21,694.8
Natrona	7,449.5	25,621.7	1,329.7	434.6	9,157.4	40,024.4
Albany	11,354.6	17,019.4	45.5	414.1	6,973.0	17,079.8
Goshen	--	14,822.7	--	412.1	6,083.7	9,321.2
Laramie	22,990.1	16,411.6	185.5	60.4	10,332.3	48,498.0
Platte	8,745.9	4,131.1	--	183.9	4,718.8	5,853.4
Big Horn	--	15,083.1	--	91.3	6,297.4	9,666.6
Campbell	6,083.8	9,157.7	--	--	5,147.9	6,250.7
Carbon	15,012.9	16,553.0	141.0	146.1	7,645.7	12,164.5
Crook	4,338.0	5,453.1	--	230.3	4,404.3	3,412.1
Hot Springs	--	6,339.2	13.2	233.2	1,293.4	5,183.0
Johnson	9,055.4	5,298.9	--	243.1	2,387.2	4,457.8
Lincoln	--	16,729.1	--	395.2	3,935.4	7,411.5
Niobrara	--	8,354.1	--	85.2	2,983.0	3,034.0
Park	--	18,559.1	3.5	55.8	9,407.0	13,721.6
Sheridan	5,076.8	11,051.7	--	547.9	4,166.6	15,173.8
Sublette	--	7,899.6	--	205.6	4,279.7	3,061.0
Sweetwater	29,005.4	13,521.0	--	735.8	7,675.5	14,581.1
Teton	--	13,597.2	--	--	3,486.0	2,871.0
Uinta	10,061.4	4,611.9	--	102.7	3,106.5	6,095.9
Washakie	--	8,196.4	7.6	282.7	2,854.2	7,223.9
Weston	--	8,333.9	--	--	4,707.5	6,444.7
(Yellowstone)	--	--	--	--	5,190.7	--

TABLE D

DAILY NO_X, SO_X AND PARTICULATE (POUNDS) EMISSIONS
FROM GASOLINE POWERED MOTOR VEHICLES

County	NO_X	SO_X	Particulates
Converse	5,123.3	150.1	200.1
Fremont	11,746.4	344.0	458.7
Natrona	12,953.2	379.4	505.9
Albany	10,045.8	294.2	392.3
Goshen	5,100.0	149.4	192.2
Laramie	16,315.7	477.9	637.2
Platte	4,900.6	143.5	191.4
Big Horn	5,167.0	151.3	201.8
Campbell	5,317.6	155.8	207.7
Carbon	10,843.4	317.6	423.5
Crook	3,571.5	104.6	139.5
Hot Springs	2,121.7	52.1	82.9
Johnson	4,926.8	144.3	192.4
Lincoln	5,180.8	151.7	202.3
Niobrara	2,643.8	77.4	103.2
Park	6,674.4	195.5	260.7
Sheridan	6,048.5	177.2	236.2
Sublette	2,703.2	79.2	105.6
Sweetwater	14,946.2	437.8	583.7
Teton	3,975.2	116.4	155.2
Uinta	5,268.6	154.3	205.6
Washakie	2,915.2	85.4	133.8
Weston	3,070.1	89.9	119.9
(Yellowstone)	4,979.7	143.9	194.5

TABLE E

DAILY DIESEL FUEL CONSUMPTION

County	Daily Vehicle-Miles	Gallons
Albany	48,748	9,558
Big Horn	17,839	3,498
Campbell	28,925	5,672
Carbon	74,876	14,682
Converse	29,793	5,646
Crook	16,568	3,249
Fremont	40,742	7,989
Goshen	19,164	3,758
Hot Springs	8,342	1,636
Johnson	24,745	4,852
Laramie	56,192	11,019
Lincoln	28,993	5,685
Natrona	51,099	10,019
Niobrara	11,640	2,282
Park	15,749	3,088
Platte	24,819	4,865
Sheridan	15,415	3,023
Sublette	9,902	1,942
Sweetwater	111,154	21,795
Teton	7,722	1,514
Uinta	37,452	7,344
Washakie	8,530	1,673
Weston	10,371	2,034
TOTAL	697,784	136,823

TABLE F

ANNUAL DIESEL FUEL USAGE BY RAILROADS IN WYOMING

County	Fuel (gallons)		
	Union Pacific	Estimated Burlington Northern	Reported Burlington Northern
Goshen	312,708	949,961	156,979
Platte		949,961	156,979
Converse		1,306,196	235,469
Natrona		2,018,666	310,032
Fremont		1,068,706	712,961
Sheridan		2,018,666	2,311,920
Campbell		1,306,197	1,723,680
Crook		1,543,686	506,160
Western		1,543,686	1,723,680
Big Horn		1,662,431	3,547,802
Washakie		712,470	591,300
Hot Springs		593,725	591,300
Albany	10,740,409		
Carbon	10,603,933		
Laramie	10,031,988		
Lincoln	4,764,103		
Sweetwater	20,796,343		
Uinta	6,397,871		
Park		237,490	
TOTAL	63,647,355	15,911,841	12,568,262

TABLE G

ANNUAL 1970 AIRCRAFT OPERATIONS FOR THE STATE OF WYOMING

County	Airport	Single Engine Light	Commercial Aircraft		Total Aircraft Operations*
			Turboprop	Jet	
Albany	Howe	2,000			
	Laramie	11,500	2,362		15,862
		13,500	2,362		
Big Horn	Basin	1,000			
	Greybull	16,000			
	Lovell	3,050			
		20,050			20,050
Campbell	Gillette	39,100			39,100
Carbon	Baggs	500			
	Encampment	450			
	Medicine Bow	500			
	Rawlins	9,950			
	Saratoga	5,050			
		16,450			16,450
Converse	Douglas	9,100			9,100
Crook	Sundance	1,000			1,000
Fremont	Dubois	1,550			
	Jeffrey City	200			
	Lander	7,050			
	Riverton	16,850	2,622		
	Shoshoni	1,000			
		26,650	2,622		29,272
Goshen	Torrington	5,090			
	Veteran	400			
		5,490			5,490
Hot Springs	Thermopolis	5,050			5,050
Johnson	Buffalo	18,720			18,720

TABLE G (Continued)

County	Airport	Single Engine Light	Commercial Aircraft		Total Aircraft Operations*
			Turboprop	Jet	
Laramie	Cheyenne	98,518	5,228	1,148	
	Pine Bluffs	200			
		98,718	5,228	1,148	105,094
Lincoln	Afton	2,065			
	Alpine	500			
	Cokeville	1,000			
	Kemmerer	600			
		4,165			4,165
Natrona	Casper	77,221	5,489	5,489	
	Harford Field	2,110			
		79,331	5,489	5,489	90,309
Niobrara	Lusk	4,012			4,012
Park	Cody	9,200	1,446		
	Powell	3,150			
	Wapiti	400			
		12,750	1,446		14,196
Platte	Guernsey	4,000			
	Glendo	3,300			
	Wheatland	3,100			
		10,400			10,400
Sheridan	Sheridan	22,100		1,384	23,484
Sublette	Big Piney	6,250			
	Pinedale	5,200			
		11,450			11,450
Sweetwater	Green River	200			
	Rock Springs	10,160	2,602		
		10,360	2,602		12,962

TABLE G (Continued)

County	Airport	Single Engine Light	Commercial Aircraft		Total Aircraft Operations*
			Turboprop	Jet	
Teton	Jackson	11,210	2,624		
	Wilson	400			
		11,610	2,624		14,234
Uinta	Evanston	1,610			
	Fort Bridger	800			
		2,410			2,410
Washakie	Worland	10,720	2,630		
Weston	Newcastle	12,600			
	Upton	810			
		13,410			13,410
STATE TOTAL		446,546	25,003	8,021	479,570

TABLE H

SOLID WASTE DISPOSAL BY COUNTY FOR WYOMING

County	Region	Population	Tons of Waste Generated at 7 Pounds Per Person per Day	Tons Collected			Backyard Incineration (tons)	Tons of Landscape and Construction Waste Collected	
				Open Burning	Incinerated	Sanitary Landfill		Open Burning	Sanitary Landfill
Converse	241	5,938	7,585	1,758			5,827	24	
Fremont	241	28,352	36,220	11,721		5,280	19,220	206	1,204
Natrona	241	51,264	65,489	562		14,220	50,708	72	1,200
Albany	242	26,431	33,765	220		2,285	31,260		220
Goshen	242	10,885	13,905	4,805			9,100	48	
Laramie	242	56,360	71,999	909		20,480	50,612	12	300
Platte	242	6,486	8,288	4,377		5	3,906	34	
Big Horn	243	10,202	13,033	3,184			9,849	50	
Campbell	243	12,957	16,553	3,500			13,053	30	
Carbon	243	13,354	17,059	3,226			13,831	110	
Crook	243	4,535	5,793	1,282			4,511	96	
Hot Springs	243	4,952	6,325	3,933			2,392	20	
Johnson	243	5,587	7,137	680			6,457	10	
Lincoln	243	8,640	11,038	1,429		1,222	8,386	16	4
Niobrara	243	2,924	3,735	1,721			2,015	52	
Park	243	17,752	22,678	4,831		4,410	13,437	22	40
Sheridan	243	17,852	22,806	5,617			17,189	84	
Sublette	243	3,755	4,796	538			4,258	40	
Sweetwater	243	18,391	23,495	4,714		1,620	17,161	44	360
Teton*	243	4,823	6,161	3,044			3,478	6,000	
Uinta	243	7,100	9,071	1,861			7,360	320	
Washakie	243	7,569	9,760	4,630			5,040	400	
Weston	243	6,307	8,057	4,625			3,433	100	
Yellowstone**	243		16,805		10,100	6,705			

*More than 7 pounds per person per day were collected in the City of Jackson because of tourists.

**Numbers are based on 6.73×10^6 visitor days with 5 pounds per person per day. Sixty percent of waste incinerated according to U. S. Park Service

AIR CONTAMINANT EMISSIONS SURVEY

Information is to be representative of Calendar Year

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

FOR OFFICE USE ONLY
Received by:
Reviewed by:
County:
Coordinates:
SIC Number:

Firm name:
Person to contact regarding this report: Title Phone
Mailing address: Plant address:
Nature of business (products):
Employees at plant location: If seasonal, give range: Approximate land area at plant location

SECTION I - FUEL USE FOR GENERATION OF HEAT, STEAM, AND POWER

Normal operating schedule: Hours per day Days per week Weeks per year
Seasonal and/or peak operation period: (Specify)
Estimate of percent of total fuel consumed to provide space heat:

	A	B	C	D	E	F	G	H	I	J	K	L
				Fuel Data (D)					Air Cleaning Equipment		Est. of Contaminants (M)	
Source No. (A)	Size of Unit (input) (B) 10^6 Btu hr	Type Unit (C)	Installation Date	Type Fuel (E)	Amount Per Yr. (F)	Heat content BTU (G)	Percent Sulfur (G-H)	% Ash (G-H) Coal only	Type (I)	Efficiency % (J)	Type (K)	Quantity (L)

SECTION II - REFUSE DISPOSAL

Refuse disposed of On site Off site-Location of disposal site and/or name of hauler:
Normal on-site combustion operating schedule: Hours per day Days per week Weeks per year
Seasonal and/or peak operation period: (Specify)

	A	B	C	D	E	F	G	H
	Waste Material						Estimate of Contaminants (M)	
Source No. (A)	Type (N)	Amount Per Year (F)	Method of Disposal (see code page 2)	Incinerator Capacity lb/hr	Auxiliary Fuel Used (O)	Type & Efficiency Air Cleaning Equipment (I-J)	Type (K)	Quantity Per Year (L)

(Use additional sheets if necessary)

AIR CONTAMINANT EMISSIONS SURVEY

SECTION III - PROCESS EMISSIONS

Normal operating schedule_____ Hours per day_____ Days per week_____ Weeks per year_____

Seasonal and/or peak operation period:_____

NOTE: For intermittent operations, indicate approximate frequency and duration so that estimates of yearly emissions may be obtained.

	A	B	C	D	E	F	G	H	I
Source No. (A)	Processes or operations releasing contaminants to atmosphere (A-P)	Installation Date	Materials processed and/or used at operations		Quantity of gas discharged from process or operation	Type and efficiency air cleaning equipment (I-J)	Estimate of Contaminants (M)		Basis of estimate (R) (Please specify basis)
			Type (Q)	Quantity Per Year (F)			Type (K)	Quantity Per Year (L)	

A - Give a different number to represent each source and then give stack data opposite the same number on Section IV.
B - Nameplate data are sufficient.
C - Hand-fired; underfeed, traveling-grate or spreader stoker; cyclone furnace; pulverized, wet or dry bottom with or without fly ash reinjection;rotary or gun-type oil burner; etc.
D - Fuel data are to be reported on "as burned basis".
E - Coke, bituminous coal, anthracite coal, No. 1, 2, 4, 5 or 6 fuel oil; natural gas; LPG; refinery or coke oven gas; wood, etc.
F - Pounds, tons, or gallons per year.
G - If unknown, please give name and address of fuel supplier.
H - Sulfur and ash content for each fuel should be a weighted average.
I - Cyclone, scrubber, electrostatic precipitator, baghouse, settling chamber, etc.
J - Please state if efficiency is a rated or operating efficiency.
K - Fly ash, sulfur oxides, etc. (include chemical description).
L - Pounds or tons per year.
M - Give stack test data if available, or otherwise specify basis used.
N - Rubbish, garbage, mixed garbage and rubbish, waste paper, wood chips or sawdust, etc.
O - Indicate whether auxiliary fuel is used in incinerators and pit burning, and the amount.
P - Sulfuric acid-chamber, aluminum smelting-crucible furnace, iron melting-cupala, cement manufacture-dry process, solvent cleaning, or other (please specify).
Q - Acid produced, tons; metal charged or processed, tons; cement produced, bbl; solvent consumed, gallons, etc. per year.
R - Process material balance studies, field tests by plant or by equipment manufacturers, or other basis.
S - List sources Sections I, II, and III which utilize each stack.

METHOD OF DISPOSAL CODE:

1. Open-burning dump.
2. Sanitary landfill. (No burning)
3. Burned in boiler or furnace.
4. Incinerator, single chamber.
5. Incinerator, multiple chamber.
6. Incinerator, rotary.
7. Conical metal burner.
8. Other. (Specify)

SECTION IV - STACK DATA

Sources Vented (S)	Height (ft)	Inside Diameter (ft)	Exit Gas		
			Temp. (°F)	Velocity (FPS)	Moisture (%)

Any supplemental material or data considered pertinent (flow diagrams, reports, summaries, test results, maps) should be submitted with this form.

Date | Name and title of official submitting reports

(Use additional sheets if necessary)

SAWMILL EMISSION QUESTIONNAIRE

DATA FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICE USE ONLY
Rec'd. by:_____
Reviewed by:_____ _____
County:_____
Coordinates:_____
SIC No:_____

I. GENERAL

A. Name of Company_____

Plant Address_____

City_____State_____Zip Code_____

B. Person to Contact_____

Position_____Telephone No._____

C. Operating Schedule_____Hrs/Day_____Days/Year

II. PROCESS INFORMATION

A. Dust Producing Operations

1. Amount/Year (tons) processed in each step:

Debarking _____

Cutting _____

Planing _____

Other _____

2. Is a burner used at this site? Yes No

If yes, give amount burned/year (tons) _____, and:

a. Date of installation_____

b. Burner Data: Base Dia. (ft)_____Top Dia. (ft)_____

Height (ft)_____Top Screen Size_____Capacity_____

c. Firing Data: % Excess Air_____Exit Gas Temp. ^{o}F_____

Type Overfire (tangential or radial) _____

Method of Charge (bulldozer, conveyor, or other)_____

d. Control Equipment: Type_____

Percent Efficiency_____Installation Date_____

CONCRETE BATCH PLANTS

DATA FOR YEAR____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICE USE ONLY

Rec'd. By: _____
Reviewed By: _____
County: _____
Coordinates: _____
SIC No: _____

I. GENERAL

A. Company Name _____

Plant Address _____

City _____ State _____ Zip Code _____

B. Person to Contact

Name _____

Position _____

Telephone No. _____

C. Average Number of Employees _____

D. Operating Schedule

_____ Hrs/Day (if seasonal, give range)

_____ Days/Year

II. PROCESS INFORMATION

A. Amount Produced During Year _____ (tons) or _____ (cubic yards)

B. Control Equipment

Type _____

Efficiency _____ %

Installation Date _____

STONE QUARRYING PROCESSING QUESTIONNAIRE

DATA FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICIAL USE ONLY
Rec'd. By:_____
Reviewed By:_____
County:_____
Coordinates:_____
SIC No:_____

I. GENERAL INFORMATION

A. Name of Firm_____

Plant Address_____City_____State_____

Mailing Address_____City_____State_____

B. Person to contact concerning this form_____

Position_____Telephone_____

C. Operating Schedule_____Hrs/Day (If seasonal, give range)_____

_____Days/Year

II. PROCESS INFORMATION

A. Raw Material Processed_____Tons/Year

B. Amount Produced_____Tons/Year

C. Crushing Operations (Please Check):

1. Primary Crushing_____
2. Secondary Crushing and Screening_____
3. Tertiary Crushing and Screening_____
4. Fines Milling_____
5. Recrushing and Screening_____
   a. Amount_____Tons/Yr.

D. Miscellaneous Operations (Please Check):

1. Screening_____
2. Conveying_____
3. Handling_____
4. Storing-Piles_____

STONE QUARRYING PROCESSING QUESTIONNAIRE

III. ADDITIONAL PROCESS INFORMATION (Not described above)

IV. STACK DATA

Source	Height (ft)	Diameter (ft)	Exit Velocity (fps)	Exit Temperature (°F)

V. CONTROL EQUIPMENT

Operation	Type of Equipment	Percent Efficiency

GYPSUM EMISSIONS QUESTIONNAIRE

DATE FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICIAL USE ONLY

Rec'd. by:_____
Reviewed by:_____
County:_____
Coordinates:_____
SIC No:_____

I. GENERAL INFORMATION

A. Name of Firm_____

Plant Address_____City_____State_____

Mailing Address_____City_____State_____

B. Person to contact concerning this form_____

Position_____Telephone_____

C. Operating Schedule_____Hrs/Day (If seasonal, give range)_____

_____Days/Year

D. Fuel Information

Type Fuel	Amount Per Year	Heat Content BTU	Percent Sulfur	Percent Ash Coal Only

II. PROCESS INFORMATION

A. Gypsum Processed_____Tons/Year

B. Type of Operations Used in Process (Please Check):

1. Raw material drying_____
2. Primary grinding_____
3. Calcining_____
4. Conveying_____
5. End Sawing_____

6. Fiber Milling_____

7. Stucco Mixing_____

8. Others (that may be sources of emissions (Please Specify)_____

III. ADDITIONAL PROCESS INFORMATION

A. Flow Sheet of Process

B. Other Information that May Aid in Evaluating Process

IV. STACK DATA

Source	Height (ft)	Diameter (ft)	Exit Temperature (^{o}F)	Exit Velocity (fps)

V. CONTROL EQUIPMENT

Operation Controlled	Type of Equipment	Percent Efficiency

INCINERATOR EMISSIONS QUESTIONNAIRE

DATA FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICIAL USE ONLY

Rec'd. by: _____
Reviewed by: _____
County: _____
Coordinates: _____
SIC No: _____

I. GENERAL INFORMATION

A. Name of Firm _____

B. Location of Incinerator

Street _____ City _____ State _____

C. Person to contact concerning incinerator:

Name _____ Position _____

Address _____ Phone _____

D. Operating Schedule _____ Hrs/Day _____ Days/Year

E. Jurisdiction(s) served (city, county, township, etc. Please specify.

_____

II. INCINERATOR INFORMATION

A. Waste Amount Burned _____ tons/year. Amount excess air _____

Type _____ _____
(Municipal, Ind. Agricultural, etc.)

B.

Number of Units	Capacity	Amount Burned	Stack Number

C. Type incinerator - single chamber, multiple chamber or other. Please specify.

_____

D. Control Equipment

Type	Efficiency	Installation Date	Amount Collected
1. Settling Chamber			
2. Settling Chamber & Water Spray			
3. Wetted Baffles			
4. Mechanical Collector			
5. Scrubber			
6. Elect. Postatic Precipitator			
7. Fabric Filter			
8. Others (Please Specify)			

III. EMISSION ESTIMATES

Type	Tons/Year
Particulate	_____
Sulfur Oxide	_____
Nitrogen Oxide	_____
Hydrocarbon	_____
Carbon Monoxide	_____
Other (Please Specify)	_____
	_____

IV. STACK DATA

Number	Height (ft)	Diameter (ft)	Exit Velocity (fps)	Exit Temperature (^{o}F)

DRY CLEANING EMISSIONS QUESTIONNAIRE

DATA FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICIAL USE ONLY
Rec'd. by:_____
Reviewed by:_____
County:_____
Coordinates:_____
SIC No:_____

I. GENERAL INFORMATION

A. Firm Name_____Phone_____

Address_____City_____State_____

B. Person to Contact_____Position_____

C. Number of Employees_____

D. Operating Schedule_____Hrs/Day_____Days/Yr.

II. PROCESS INFORMATION

A. Amount of Clothes Cleaned Per Year_____tons

B. Number of Customers/year (approximately_____

C. Type of Solvent

Petroleum Base_____gal/year

Synthetic Base_____gal/year

Other (Please Specify)_____

D. Control Equipment

Type	Efficiency	Installation Date	Amt. Recovered gal/yr
Condensor			
Absorber			
Other (Please Specify)			

FERTILIZER QUESTIONNAIRE

DATA FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICIAL USE ONLY
Rec'd. by:_____
Reviewed by:_____
County:_____
Coordinates:_____
SIC No:_____

I. GENERAL INFORMATION

A. Name of Firm_____

Plant Address_____City_____State_____

Mailing Address_____City_____State_____

B. Person to contact concerning this form:_____

Position_____Telephone_____

C. Operating Schedule_____Hrs/Day (if seasonal, give range)_____Days/year

II. PROCESS INFORMATION

A. Nitrate Fertilizer

1. Amount of Fertilizer Produced_____tons/year
2. Type Equipment (Please Check)
   a. Granulator _____ or Drilling Tower _____
   b. Neutralizer _____
   c. Dryers and coolers _____

B. Phosphate Fertilizer

1. Amount of Fertilizer Produced_____tons/year
2. Type of Product (Please Check)
   a. Normal Superphosphate _____
   b. Triple Superphosphate_____
   c. Diammonium Phosphate_____
3. Type of Operations (Please Check)
   a. Grinding _____
   b. Drying _____
   c. Cooling _____
   d. Granulating _____
   e. Packaging, Shipping _____

C. Control Equipment

Operation	Type of Equipment	Percent Efficiency

D. Stack Data

Source	Height	Diameter	Exit Temperature	Exit Velocity

III. ADDITIONAL PROCESS INFORMATION (not described above)

A. Flow Sheet of Process

B. Other Information Not Mentioned Above

ASPHALT BATCH PLANTS

DATA FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICE USE ONLY

Rec'd. By: _____
Reviewed By: _____
County: _____
Coordinates: _____
SIC No: _____

I. GENERAL

A. Company Name _____

Plant Address _____

City _____ State _____ Zip Code _____

B. Person to Contact

Name _____

Position _____ Telephone _____

C. Average Number of Employees _____

_____ Hrs/Day (if seasonal, give range)

_____ Days/Year

II. PROCESS INFORMATION

A. Amount of Asphalt Produced During Year _____ (tons)

B. Control Equipment on Drayer

Equipment Type	% Efficiency	Installation Date
Precleaner		
Cyclone		
Scrubber		
Centrifugal		
Orifice Type		
Baffle Spray Tower		
Bag House		
Other		

C. Fuel Use

Type _____ Amount

CRUDE OIL DRILLING, NATURAL GAS
AND LPG FACILITIES QUESTIONNAIRE
DATA FOR YEAR_____

OFFICE USE ONLY

Rec'd. by:_____
Reviewed by:_____
County:_____
Coordinates:_____
SIC No:_____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

I. GENERAL INFORMATION

A. Company Name_____

Plant Address_____City_____State_____

Mailing Address_____City_____State_____

B. Person to contact about this form_____

Telephone_____Position_____

C. Operating Schedule: Other than continuous operation, please specify:

_____

II. PROCESS INFORMATION

A. Drilling Operations: Type of well (natural gas or crude)_____

Quantity pumped (bbl, gal, cu ft,per yr)_____

Oil_____Water_____

Casing-head gasoline_____Sulfur content of crude_____

Amount flared_____H_2S Content_____

Sump loss_____(bbls, gal per yr)

B. Crude Handling and Storage

Amount transferred to storage_____(bbls, gal per yr)

Type storage tanks (floating or fixed roof)_____

No. of tanks_____Height_____(ft) Diameter_____(ft)

Sump loss_____(bbl/yr)

C. Natural Gas Operations and LPG Plants

Cu. ft. processed/yr. (compressed, absorbed, etc.) specify processes_____

_____

Fuel burned/yr: In boilers_____In gas engines_____

Boiler capacity (BTU/hr)_____Stack height (ft)_____

Dia.(ft)_____Exit Vel._____(ft/sec) Exit temp._____ ^{o}F

NOTE: Fill out separate questionnaires for each location.

QUESTIONNAIRE FOR CONICAL BURNERS

DATA FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICE USE ONLY

Rec'd. by: _____
Reviewed by: _____
County: _____
Coordinates: _____
SIC No: _____

I. GENERAL

A. Name _____

Burner Location _____

City _____ State _____ Zip Code _____

B. Person to Contact

Name _____

Position _____ Telephone No. _____

C. Operating Schedule

_____ Hrs/Day (if seasonal, give range)

_____ Days/Year

II. PROCESS INFORMATION

A. Burner Data

Base Diameter _____ Top Diameter _____

Height _____ Top Screen Size _____

B. Firing Data

Percent Excess Air _____ Exit Gas Temp. _____

Type Overfire: _____ (Tangential or Radial)

Method Charge: _____ (Bulldozer, conveyor or other)

C. Waste Information

Type	Amount (tons/year)
Municipal Refuse	_____
Sawdust	_____
Planer Shaving	_____
Bark	_____
Other (please specify)	_____

III. CONTROL EQUIPMENT

Type _____ Percent Efficiency _____ Installation Date _____

QUESTIONNAIRE FOR GRAIN HANDLING OPERATION

DATA FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICE USE ONLY
Rec'd. by:_____
Reviewed by:_____
County:_____
Coordinates:_____
SIC No:_____

I. GENERAL

A. Company Name_____
Plant Address_____
City_____State_____Zip Code_____

B. Person to Contact
Name_____
Position_____Telephone No._____

C. Average Number of Employees_____

D. Operating Schedule
_____Hrs/Day (if seasonal, give range)
_____Days/Year

II. PROCESS INFORMATION

A. Terminal Elevators — Tons/Year
1. Shipping or Receiving _____
2. Transferring, Conveying, etc. _____
3. Screening and Cleaning _____
4. Drying _____

B. Country Elevators — Tons/Year
1. Shipping or Receiving _____
2. Transferring, Conveying, etc. _____
3. Screening and Cleaning _____

C. Grain Processing — Tons/Year
1. Alfalfa Dehydrating _____
2. Alfalfa Meal Milling _____
3. Corn Meal _____
4. Soybean Processing _____
5. Malted Barley or Wheat Cleaner _____
6. *Milo Cleaner or Rice Dryer _____
7. *Barley Flour or Rice Milling _____
8. Wheat Milling _____

D. *Feed Manufacturing _____

E. Control Equipment
1. Type of Dust Collector(s) (Specify separately for each process with emissions) _____
2. Design Efficiency _____
3. Quantity Retained in Collector(s) _____ (tons/year)

*SPECIFY WHICH

PETROLEUM REFINERY EMISSIONS QUESTIONNAIRE
DATA FOR YEAR ____

Return to: Mr. Robert E. Sundin, Director
Section of Industrial Hygiene
Division of Health & Medical Services
State Office Building
Cheyenne, Wyoming 82001

OFFICE USE ONLY
Rec'd. by:_____
Reviewed by:_____
County:_____
Coordinates:_____
SIC No:_____

I. GENERAL INFORMATION

Firm Name_____
Person to Contact_____ Title_____ Phone_____
Address of Plant_____ City_____ State_____
Mailing Address_____ City_____ State_____ Zip Code_____
Amount of Crude Processed_____ Barrels/year Plant Capacity_____ Barrels/Day
Employees at Plant Site_____ Land Area at Site_____
Normal Operating Schedule_____ Hours/Day_____ Days/Year
Type of Sulfur Recovery System_____ Amount Removed_____ Method of Disposal_____

II. FUEL USE FOR GENERATION OF HEAT, POWER, STEAM

A	B	C	D	E	F	G	H	Stack Data		
Source No.	Size Unit (input) 10^6 BTU/Hr.	Installation Date	Type Fuel	Amount Per Year	Heat Content	Percent Sulfur	Height (ft)	Diameter (ft)	Exit Velocity (fps)	Exit Temp. (^oF)

III. (a) PROCESS INFORMATION

Number	Process or Operation Releasing Contaminants To Atmosphere	Materials Processed and/or Used at Operation		Control Equipment		
		Type	Quantity/Year	Type	Installation Date	Efficiency
101	Catalytic Cracking Unit Type_____	Fresh Feed	_____Barrels			
102	Cooling Towers	Cooling Water	_____10^6 Gals			
103	Vacuum Jets	Vacuum Feed	_____Barrels			
104	Process Drains	Waste Water	_____Barrels			
105	Compressor Int. Comb. Engines	_____Gas	_____1000 $Ft.^3$			
106		Emissions Will be Estimated from Plant Capacity				
107	Storage Tank No. Fixed Roof_____ No. Floating Roof_____	Throughput _____10^3 Gal _____10^3 Gal	Total Capacity _____10^3 Gal _____10^3 Gal			

IV. (a) EMISSION AND STACK INFORMATION FOR ABOVE PROCESSES

	Check Type				Stack Data				Emission Estimates (Tons/Year) to Atmosphere						
Source No. of Process Above	Stack	Flare	Tank Farm	Fugitive Loss	Height (ft)	Diameter (ft)	Exit Velocity (fps)	Exit Temp. °F	Particulates	Sulfur Oxides	Carbon Monoxide	Hydro-carbon	Nitrogen Oxides	Other	Basis of Estimate

PETROLEUM REFINERY EMISSIONS QUESTIONNAIRE

III. (b) PROCESS INFORMATION (Other possible sources not identified)

Number	Process or Operation Releasing Contaminants To Atmosphere	Materials Processed and/or Used at Operation		Control Equipment		
		Type	Quantity/Year	Type	Installation Date	Efficiency

IV. (b) EMISSION AND STACK INFORMATION FOR ABOVE PROCESSES

Source No. of Process Above	Check Type				Stack Data				Emission Estimates (Tons/Year) to Atmosphere						
	Stack	Flare	Tank Farm	Fugitive Loss	Height (ft)	Diameter (ft)	Exit Velocity (fps)	Exit Temp. °F	Particulates	Sulfur Oxides	Carbon Monoxide	Hydro-carbon	Nitrogen Oxides	Other	Basis of Estimate

NOTE: 1. Any supplemental material or data considered pertinent (flow diagrams, plant layouts, emission tests or reports, etc) should be submitted with this form.

2. Duplicate this or any page if more space is required.